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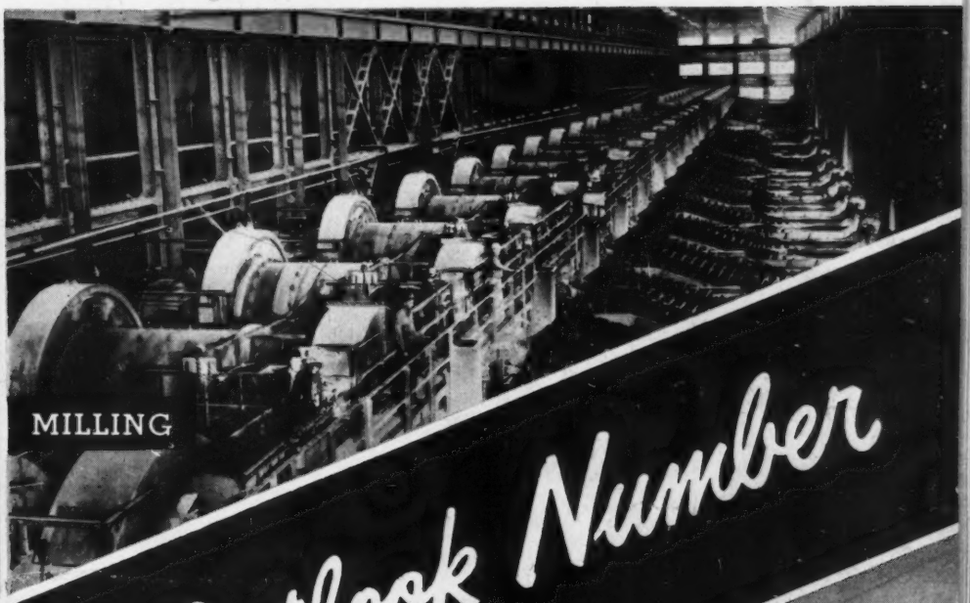

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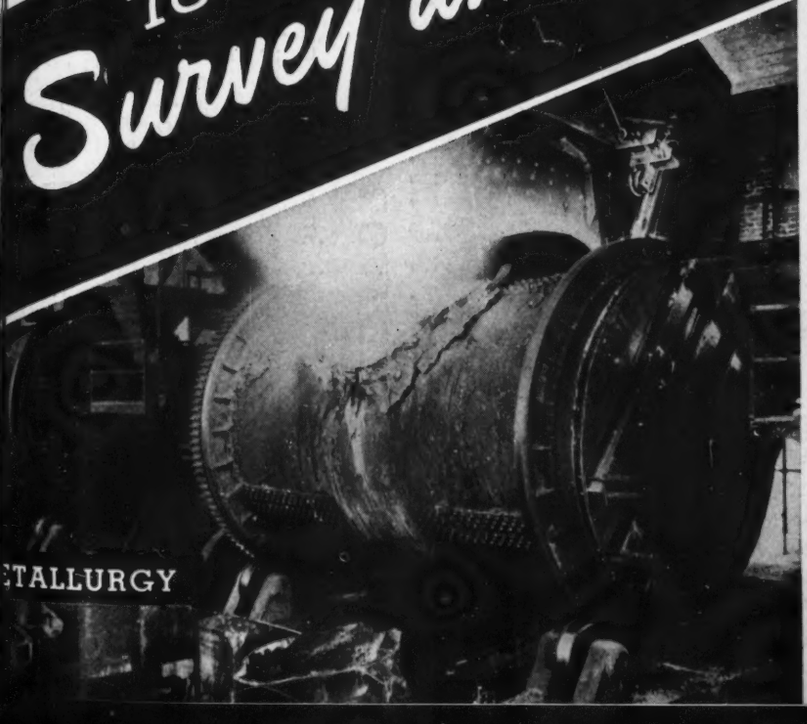

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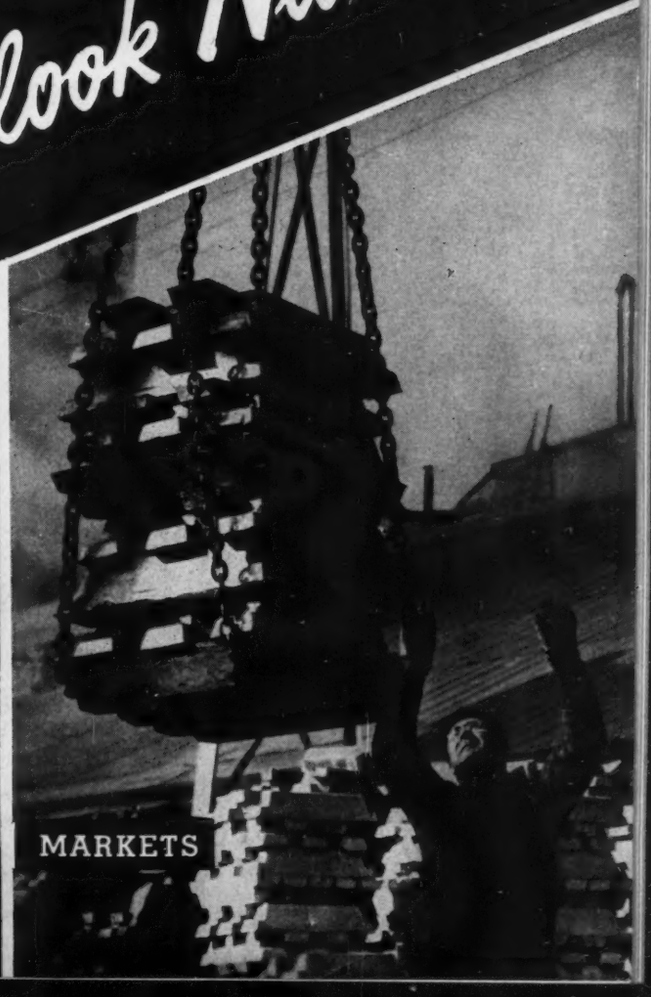

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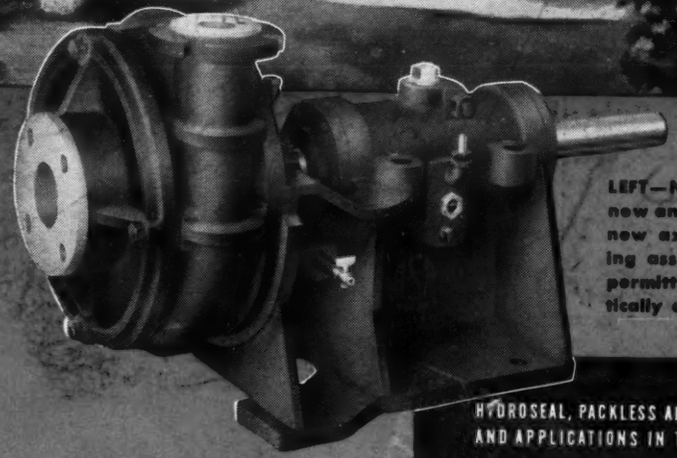

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ENGINEERING AND MINING JOURNAL

FEBRUARY, 1947

Boom in Durable Goods to Continue After "Correction"

EVAN JUST, Editor

The mining industry enters 1947 "riding high." Almost every economic factor directly affecting it points to strong demands, sustained high prices, and improved opportunities for profit. Will these favorable conditions persist without abatement through 1947? The answer is: Probably not, but beyond the low area is high ground.

Many Favorable Influences

TO SUMMARIZE the favorable factors, in 1946 the price controls and other Government restraints which caused widespread dissatisfaction and inconvenience during the war were virtually wiped off the boards. Except for tin, control is reduced to the field of consumer inventories. Even this restraint can hardly be considered as meaningful, in view of the lack of related measures and the rapid disintegration of the Office of Temporary Controls. The industry enjoys free markets, almost unbelievable demands for most of its output, unprecedentedly high prices for peacetime, and substantial alleviation of its labor shortages. The excess-profits tax is gone, and the outlook is for further tax reductions. Labor leaders know that the era of their sacrosanctity is passed and that they are due to be saddled with responsibilities commensurate with their power and privileges. Workers are realizing that the only sound way to improve their lot is through cooperation toward greater productivity. High-cost copper, lead, and zinc producers, who would normally have to face the natural consequences of postwar relaxation of requirements, are sustained, temporarily at least, by continued subsidy payments. The market is buttressed by the large unsatisfied requirements for emergency stockpiling. These needs are probably large enough to make it questionable if for many minerals they can be fulfilled within five years without embarrassing civilian supplies.

Unfavorable Aspects

However, over this auspicious outlook hang a few clouds, some of which might possibly develop into squalls. First, nobody can tell at this writing how deeply back-pay claims under the Supreme Court's interpretation of the Wage-Hour law may cut into industry's finances. The union with which most mining operations are concerned has just re-established a leadership alleged to be devoted to the Communist party line. However, there is evidence of increasing insurgency among the membership. Second, the State Department has listed a number of minerals and mineral products for possible tariff cuts. If duty reductions are made on the basis of the present exaggerated demands and high prices, affected domestic pro-

ducers are likely to be handicapped when demands slack off. On the other hand, the new Republican-dominated Congress is likely to damp or even wreck the State Department's program, which is already jeopardized by foreign reluctance to relax trade barriers multilaterally. Third, for various reasons discussed below, the Premium Price Plan seems unlikely to afford high-cost producers the same benefits they have been receiving during the war years.

Corrective Movement Due

But the one depressive influence which overshadows all others is the probability of a corrective economic adjustment in 1947. Such a development can hardly fail to have repercussions on the mineral price structure. In a nutshell, the expectancy of a general setback is sufficiently widespread almost to guarantee the event.

The cause of the expected let-down is simply that prices of consumer goods are so high that markets are bound to be thin. In order to develop the broad markets necessary for sustained prosperity, prices must come down. New wage demands, already in the offing, will only aggravate this situation.

This is not to say that five years hence prices may not be as high as at present and wages even higher. In our opinion, the Government will be virtually forced to adopt inflationary policies if the gross national product falls below $150,000,000,000 per year, in order to make its enormous tax requirements tolerable. Nevertheless, although buyers may accept present prices if they come gradually, particularly if greater industrial efficiency brings higher wages and salaries, for the present the bulk of consumers are disinclined to satisfy their wants at prevailing prices. The deflationary process is already evident in the numerous price slashes made by retail sellers, even during the Christmas season.

A contributing factor to an economic setback is the unbalance of manufacturers' inventories. Because of strikes and material shortages in 1946, most durable-goods manufacturers have been burdened with distorted inventories that have strained their financial resources and credit. Purchases, which a year ago were keyed to available supplies, are now geared to the bottlenecks, and a generally conservative attitude prevails toward inventory growth.

Metal Prices to Stay High

Even if no general let-down occurs, the mining industry can expect some subsidence of the present frantic demands for many of its products. A substantial portion of these requirements represents "pipeline filling," which is bound to be of limited duration. Nevertheless, the pent-up needs for durable goods are so great that we believe the mining industry will fare relatively well in any setback of limited duration. Most durable-goods manufacturers have backlogs of orders which will keep them occupied for many months, and such checks as they have been able to make indicate the orders to be quite firm. Also, whenever construction costs are brought to levels which invite investment, the backlog of construction needs is colossal. Almost the whole gamut of mine products may be expected to benefit from a construction boom.

Also, the prices of minerals promise to be sustained by the labor-cost platforms, foreign and domestic, which have been thrust under producers during the war. Nobody expects wages, foreign or domestic, to recede to prewar levels, as they are upheld by government policies and by the tremendous power which unions have acquired in all countries in recent years. Between tax problems and labor-union pressures, most governments, our own included, will find inflation an easier course than wage reductions if their economies should falter because of high production costs. This indirect method of scaling down debts and wages is bound to be—as it has always been—the choice of politicians over a frank acceptance of direct adjustments. In this connection, employers in general do not anticipate wage reductions below present levels as a means of lowering operating costs. They look to higher productivity per worker and improved methods as the devices by which their prices can be brought to levels acceptable to consumers.

Whither Premiums?

In the matter of protecting domestic industry, anything can happen in 1947. The range of possibilities in the tariff field is mentioned above. The outlook for the other form of protection accorded high-cost domestic producers, direct subsidies, currently embraced in the Premium Price Plan, is equally uncertain. The plan was legislated to continue until June 30, 1947. However, losses of personnel by the administrative agency threaten to vitiate the plan before its expiration date. Also, the usefulness of the plan to its beneficiaries is greatly reduced by the Executive rules governing its administration. The present system is to reduce premiums to the same extent that prices increase. Although on casual scrutiny this program appears to fulfill the legislative mandate to carry the plan forward "under terms not less favorable to the producer than heretofore," it takes no account

of the increases in smelter charges as prices rise or of the higher freight rates now in effect. Accordingly, the recipients of premiums are getting far less income under prevailing prices than they received under OPA ceiling prices. Possibly this failure to execute the will of Congress may open the way to claims under the Contract Settlement Act (E.&M.J., July 1944; p. 103). This Act guarantees redress to war contractors who in good faith fulfilled contracts, expressed or implied, formal or informal, with Government agencies, including the War Production Board.

A drive is impending to set up direct payments to high-cost producers as a permanent policy. Offhand, it seems as though this project will be smothered by opposition, as the Republican leaders are unfriendly to subsidies and the larger mining operators, sick of Government controls of all kinds and faced with a generally favorable outlook, are strongly free-enterprise minded. Nevertheless, there is a host of small operators dependent on subsidies, and Western members of Congress are not indifferent to their fate. Also, the anti-conservational aspects of abandonment of some operations is likely to receive consideration.

Currency Regulation Likely

The author of the discussion on gold in this issue does not foresee any basis for expecting devaluation of currencies in terms of gold, and points out that this would be an illogical way to combat inflation. He sees the restoration of high industrial efficiency and productivity as the soundest way of curing gold's ills. The logic of this reasoning is indisputable. To it might also be added the sound views expressed by Dr. Donald McLaughlin at Denver recently*, that optimum conditions for the gold miner involve combating inflation and inducing a high level of international trade.

Nevertheless, in our opinion general currency devaluation, i.e. a higher gold price, continues to be probable. As we see it, inflation will be viewed as a problem only so long as reconversion is incomplete, productivity is low, and world trade is hamstrung. When more normal conditions are established, debt-burdened governments will be more concerned with maintaining what they view as a desirable level of inflation than with deflationary objectives. This will be particularly true if and when depression conditions develop, as shrunken economies will find it difficult to bear the present weight of national debts. The extent to which gold producers will benefit from devaluation will be qualified by any new special taxes or seignorage that may be imposed, and by the degree to which commodity prices actually reflect devaluation.

Events during the past year have definitely favored the retention of gold as an international measure of currency values. The continued financial embarrassment of governments and the slow progress made by the International Fund and Bank point up the need for an international financial "policeman" that cannot be swayed by policies based on wishful thinking. Events during 1947 seem likely to emphasize this need.

Some Beneficial Aspects

From a long-range viewpoint, an economic check in 1947 may not be entirely red ink in the ledger, for both the American commonwealth and the mining industry. From the national viewpoint, it must be admitted that probably we are as vulnerable as ever to the painful sags to which a highly productive economy is susceptible. The stabilizing measures which have been instituted, such as old-age annuities and unemployment insurance, have scarcely offset the average gain in productivity. Thus, if a setback causes the nation to take stock and possibly to establish additional precautions against depression, the action may forestall more serious shock that might otherwise occur at some future date.

From the mining industry angle, with a favorable outlook and the end of an era in which management has been a favorite whipping boy, there is danger that mining leaders may tend to concentrate on private problems and neglect the development of a sound national mineral policy. Because the mining industry cannot successfully divorce itself from public problems, whether they involve peacetime raw-material supplies or national security during an emergency, its best interests require that it should exercise constructive, objective leadership in the mineral-policy field.

Also, paradoxical as it may seem, forward planning might be encouraged by prices "going through the wringer" in a corrective period. Any price levels that survive such a process offer a more dependable basis for planning investments than a price structure which has risen sharply under the pressure of abnormal demands.

Long-Term Optimism

However, despite the probability of a general readjustment in 1947, there are grounds for optimism based on the long-range outlook. Virtually all business leaders and economists view the expected dip as a temporary corrective movement and believe that a durable-goods boom of approximately five years' duration lies beyond. In such expectations the favorable implications to mining are obvious.

* *Mining Congress Journal*, Nov., p. 36.

METALS

SURVEY and FORECAST

COPPER

Prospects for record peacetime use to continue are favorable. High prices expected to stimulate production

★★★★★★★★★★★★★★★★★

H. H. WANDERS, Market Editor

FAR MORE COPPER was consumed in the unsettled transition period than most observers thought possible. The fabricating division of the domestic copper industry placed 1946 consumption of refined copper at 1,240,000 tons, an all-time high for a peacetime year. During the last quarter of 1946, with labor disturbances at a minimum, consumption actually moved up to the rate of 1,560,000 tons a year. The only rational explanation for this unprecedented demand is that the shelves must have been bare and pipe lines for peacetime goods empty. The need for copper and products containing copper apparently extended from the manufacturer's plant right through to the end product. As 1946 ended it was quite evident that an undetermined period still remains before a condition of normalcy returns and production and demand will again revolve around current consumption.

Work stoppages due to strikes, higher costs, and delayed price correctives by OPA proved to be major obstacles to producers who all along recognized that increased production was the top need for industry. As in the war years, deficiencies in domestic production were relieved materially by copper available from the Government's stocks and new importations. Domestic production suffered in comparison with the record of the preceding year, output of refined copper in 1946 amounting to 604,071 tons. Shipments to consumers totaled 1,267,921 tons. The Government's stockpile declined during the year from 550,000 tons to 92,000 tons. Imports for the year totaled 375,000 tons (copper in all forms), according to preliminary estimates.

Bulk purchases of copper by the British Ministry of Supply and the Office of Metals Reserve continued throughout the year. Such buying was received favorably as the year opened, largely because foreign producers, with few exceptions, could not visualize a speedy industrial recovery for countries outside of the Americas. In fact, production abroad lagged in spots pending clarification of the business outlook. It was not long, however, before demand readily absorbed all foreign offerings and producers began to encounter difficulties because of strikes, fuel and waterpower shortages, and transportation bottlenecks.

During February, a distinct disinclination developed to continue selling foreign copper at wartime prices. The free market continued to expand, with buyers raising their bids to 12c. f.a.s. equivalent, New York, and higher. The need for restoring power facilities to war-torn Europe and other areas was so urgent that means were found for financing such developments even though the home economies of affected countries were in a bad way. So dependent is the world on electrical energy that no time was lost in obtaining generators, motors, transmission wire, etc. Price appeared to be of secondary importance.

Free Market Price Restored

An event of prime importance to the copper industry was the establishment of a world price in March 1946. With the British on a bulk-buying basis, and prospects for resuming trading on the London Metal Exchange remote, world producers accepted the New York export equivalent, based on reports of sales, as a fair quotation and price index of the state of the market. In moving from wartime to free market quotations for foreign copper *Engineering and Mining Journal* said:

"Though 'bulk buying' of foreign copper by governments is likely to continue for some time, the volume of business transacted daily in foreign copper in the

free market has been expanding since the beginning of the year. This volume has attained proportions that again make it possible to establish a quotation that can be accepted as a measure of value for copper sold outside of the United States. Effective March 14, our export quotation for copper reflects prices obtained by foreign producers in the open market."

Between bulk buying by government agencies, increased competition for copper from other sources, and shrinking supplies as a result of labor unrest, prices in the foreign market began to move upward to a more realistic selling basis. The domestic situation could not be insulated from the general upward price trend, and pressure to adjust the ceiling price mounted steadily. OPA was extremely price conscious in the matter of protecting the consumer, but moved slowly to assist the producer of basic raw materials.

Strikes restricted production in this country to such an extent that the Civilian Production Administration in the second quarter of the year called on producers to ration copper on a voluntary basis. Then, on April 29, came the famous report of the "Fact-finding Board," recommending a general wage increase of 18½c. an hour, with price relief to follow. OPA finally raised the domestic ceiling price on June 3, 1946, to 14⅜c., Connecticut Valley, or 2⅜c. higher than the wartime ceiling that became effective on Aug. 12, 1941. Only those producers were permitted to sell copper at the higher levels who had granted approved wage contracts.

By mid-year, work stoppages at Chile Copper, reduced output in Northern Rhodesia, and a scarcity of special shapes in the United States market, created a situation that was described as "tighter than under war conditions." Metals Reserve helped out by releasing 85,000 tons of foreign copper for domestic consumption during June.

A bill extending price control, unacceptable to the Administration, was vetoed by President Truman on June 29, thereby legally interrupting price control. Though prices of other major non-ferrous metals advanced immediately, copper remained unchanged except for the imposition of higher premiums by refiners for casting special shapes, to offset increased costs. OPA was revived on July 25, causing the premiums on special shapes to fall back to the old level, pending study by the pricing agency. This move only served to aggravate the supply situation for consumers, hampering operations at wire and rolling mills. OPA finally raised the premiums on special shapes $2 to $4 per ton, effective Oct. 14.

Domestic Output Rises

With most strikes in this country settled, production of copper increased steadily throughout the third quarter. Consumption also increased, and stocks of foreign copper in the hands of the Government were drawn upon heavily partly to meet the heavy demands.

As October ended the prospects for price decontrol were viewed as slim. The election returns early in November reversed the outlook completely. Price control in copper suddenly ended on Nov. 9, and Kennecott took the initiative among producers and raised its price to the basis of 17½c., Valley. Shortly thereafter it was announced that the bulk buying program of the Government would end, except for existing obligations and deals still pending. This was the spark that caused Phelps Dodge, on Nov. 20, to announce that its selling basis has been raised to 19½c. There was strong opposition to this move, and price confusion existed for three days as Kennecott continued to sell metal on the old basis. Anaconda, a buyer on balance in the United States market, took a neutral position. Demand continued active at the higher price that became firmly established on Nov. 23 at 19½c.

The upward movement in foreign copper prices to 17½c. f.a.s. New York undoubtedly was a factor in lifting the domestic price to 19½c. It was argued in some quarters that the domestic price in time would have to rise to the import basis, plus the import tax, because continued heavy importations by private interests would have to replace bulk buying by the Government to satisfy the heavy postwar demands. The present 4c. import tax, most observers agree, will be lowered eventually, most likely by 50 percent under the State Department's foreign trade program. A move to waive the import duty temporarily, as in lumber, got nowhere. Copper available from supplies owned by Metals Reserve is expected to shrink to a low level by the end of the first quarter of 1947. In the event that domestic consumption continues at the rate of 120,000 to 130,000 tons a month, imports will be necessary, even though domestic production is likely to rise under stimulation of higher prices.

With price again the all-important factor in regulating the copper market, it is reasonable to assume that production during 1947 will rise. At around present prices, domestic production of refined copper should increase to 1,000,000 a year or more, providing work stoppages do not interfere. Production in Canada, Latin America, and Africa should be higher than last year. Consumers' "pipe lines" will fill up sooner or later and buyers are bound to become more price conscious as competitive conditions return. From present indications the shift from the seller's to a buyer's market is not likely to occur in the first half of 1947. Despite a probable easing in the abnormally high rate of consumption at some later date, a high level of consumption for copper should continue throughout the year. Worldwide unsatisfied demands for copper for replacements and new construction have probably been underestimated.

U. S. Copper Statistics

(Copper Institute)

In Tons

	Production		Deliveries
	(a) Crude	Refined	(b) Domestic
1941	1,016,996	1,065,667	1,545,541
1942	1,152,344	1,135,708	1,635,236
1943	1,194,699	1,205,871	1,643,677
1944	1,056,180	1,098,788	1,636,295
1945	841,667	843,113	1,517,842
1946:			
January	58,178	69,008	115,601
February	41,667	49,923	86,089
March	41,832	20,139	58,590
April	29,280	18,989	75,756
May	31,897	20,551	93,647
June	32,785	23,870	95,267
July	56,906	43,606	97,527
August	64,462	59,591	118,381
September	69,748	67,803	113,158
October	72,807	77,947	136,481
November	73,024	75,066	129,206
December	78,140	77,578	148,218
Totals	650,726	604,071	1,267,921

(a) Mine or smelter production or shipments, and custom intake including scrap. (b) Beginning March, 1941, includes deliveries of foreign copper for domestic consumption.

LEAD

Relaxation of controls and higher prices afford basis for expanding production

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FELIX E. WORMSER, Secretary
Lead Industries Association, New York

THE OUTSTANDING EVENT of 1946 for lead was its release from Government controls and the restoration of a competitive or open market. For a time it appeared that Congressional action would be necessary before the lead market could again be free of price control, and import and use restrictions, but the emphatic decision of the American people on election day accelerated events with almost bewildering rapidity. Hence, in November the industry was suddenly almost entirely on its own once more, with the natural economic forces of the market place again at work to relieve the lead shortage.

Government price control remains in some other lead-producing countries. Thus, in Canada and Australia lead consumption, and probably hoarding, is stimulated by low ceiling prices. In Canada consumers can purchase Canadian lead at 5c.* per pound for domestic fabrication and use, although the world market is over 11.5c. per pound. No wonder lead consumption in Canada has broken all records and is now about 60,000 tons per year, compared with 20,000 tons prewar.

A great change has taken place in the lead economy of the United States since the war. In the first place, the demand has grown to an extraordinary extent. Although it was considered reasonable to expect a consumption of lead in the United States of 800,000 tons per year before the war, we must now supply a demand for more than 1,000,000 tons per year, a demand which may grow rather than diminish as the population of the country increases. In the second place, the United States is no longer self-contained in lead—that is, no longer will domestic mine production plus scrap and a small amount of lead derived from imported concentrates be able to furnish the requirements of industry. A substantial volume of pig-lead or concentrate imports will be needed in addition.

This fundamental alteration of our domestic lead picture is clearly shown in the accompanying table covering the relationship between domestic mine production, scrap production, and imports.

The course of imports since 1937 is noteworthy. Without the dramatic increase in imports during the war, breaking all records, our war effort in lead would have suffered. In peacetime, in 1946, the Government, as sole importer, limited imports into the United States under an agreement with Great Britain, and absorbed the losses involved in making foreign lead purchases and selling the metal at lower ceiling prices here. Import control, plus the defects of the subsidy system for domestic mines prevailing in the United States, intensified the lead shortage.

Beginning in January 1947, imports of lead into the United States, especially from Canada, Mexico, and Australia, should increase. Peru is expected to continue to ship lead regularly here. The final answer as to who gets the free output of foreign lead producers now depends on the open-market price, not government edicts. This is as it should be, even though it would be regrettable, during periods of stringency, to see the lead market reach a price level it could not hope to hold for any length of time.

Not only did the war curtail the prospecting and development necessary to keep an adequate ore reserve in sight but it dislocated labor rates and supply to such an extent that the mining industry lost an important part of its labor and still has not been able to recover its normal complement of manpower. Only recently has there been a noticeable return of men to the mines, but they are still short some 2,500 men out of 12,000 needed for full production. In Idaho and Utah the restoration of the six-day week should help to improve output; but until exploration and development work have been caught up and new deposits discovered, which are time-consuming operations, lead production in the United States cannot be expected to reach the levels of the late 30's.

Most Producers Still Get Subsidy

Despite the recent increase in the price of lead on Jan. 6 to 13c. per pound, New York, the highest on official record, most producers in the United States are still receiving a subsidy. Only a few of the largest producers are now subsidy-free. In fact, the average price of the lead produced in the United States, both subsidy-free and subsidized, is well above 13c. This poses a problem, however, when subsidies expire by law on June 30, 1947. The market price then will be more indicative than the market today of the level needed to encourage the continued production of many marginal and currently subsidized operations.

Although domestic mine production amounted to only about 330,000 tons in 1946, the lowest since 1934, we may confidently look for an increased production in 1947 barring strikes or other labor difficulties.

Scrap-lead production now assumes an importance greater than ever in helping correct the lead shortage. In 1946 scrap and new lead were produced almost ton

UNITED STATES LEAD SUPPLIES (1937–1946)[a]

(In Short Tons)

	U. S. Mine Production	Secondary Production	Imports (*b*) (Lead Content)	Total Supply (*a*)
1937.....	465,000	275,000	41,000	781,000
1938.....	370,000	225,000	64,000	659,000
1939.....	414,000	242,000	87,000	742,000
1940.....	457,000	260,000	282,000	1,000,000
1941.....	461,000	397,000	381,000	1,240,000
1942.....	496,000	323,000	492,000	1,312,000
1943.....	453,000	342,000	319,000	1,115,000
1944.....	417,000	331,000	321,000	1,070,000
1945.....	391,000	363,000	300,000	1,054,000
1946 (Est.)...	330,000	350,000	135,000	815,000

(*a*) Exclusive of stocks.
(*b*) Pig lead plus recoverable lead in concentrates.
Note: Based upon statistics of the U. S. Bureau of Mines, U. S. Bureau Census, and American Bureau of Metal Statistics.

* The ceiling was upped to 10.625c. on Jan. 22, 1947.

for ton. Scrap production is fairly uniform from year to year, but not from month to month, as the Government war agencies learned to their dismay when they found that scrap would not appear on the market at any price they set. Scrap dealers are sensitive to market forces, and, being only human, want to obtain as much as they can for their product. The OPA discovered this when that agency rolled back the price of lead after the OPA "holiday" from 9.50c. to 8.25c., far below its world value.

The lead market thus enters 1947 with a demand for more than 1,000,000 tons for the year, much of it for essentially non-competitive uses such as storage batteries, cable covering, ethyl lead, solder, and certain pigments. Domestic mine production should be greater, barring strikes; scrap the same or better; and imports should increase greatly.

What effect higher postwar prices will have on the uses of lead no one can tell. Some uses appear vulnerable; for others price is little hindrance to use. However, there is no better way than the operation of a free market to determine who shall obtain the available lead. Higher prices have stimulated production in the past and encouraged substitution. Certainly, this will happen again. The miner can comfort himself for those markets he is apt to lose, that some markets he captured in war he may keep, mainly at the expense of tin in solder and bearing metals. At any rate, the future looks especially bright for any one owning a lead mine these days.

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ZINC

Some price adjustments likely in 1947 as foreign production of metal expands. Possible tariff changes a factor

★★★★★★★★★★★★★★★★★

CHARLES R. INCE, Manager of Metal Sales, St. Joseph Lead Co., New York

THE PAST YEAR marked the return of zinc to a free market after five years of price control. However, at the end of 1946 there still remained other factors which precluded a full return to a normal market, solely responsive to the law of supply and demand. Among these were inventory and export controls, subsidies, and Government policy on releases from stockpile.

Though zinc production was in excess of domestic shipments, metal stocks declined during the year and prices rose with the removal of ceilings. This was primarily due to shipments for Government account, presumably for permanent stockpile, and heavy exports which were given impetus by the removal of price ceilings on drawback material in June and the higher foreign price which prevailed during the last half of 1946.

The year can roughly be divided into two periods. The first half, when the foreign price was generally below the United States level, ranging from 7⅝c. to 8¼c. per pound f.a.s. Gulf ports, and the latter half, when the foreign price rose to the domestic level and above. Naturally, the first period discouraged exports and encouraged imports. Exports totaled 18,000 tons and imports 70,000 tons during the first six months. In the last half of the year exports rose to 49,000 tons, and imports dropped to a rate of 3,000 tons per month. As would be expected under such conditions, domestic consumers found zinc relatively easy during the first six months and rather tight during the last half of the year.

The domestic zinc market remained unchanged at the OPA ceiling of 8¼c. East St. Louis for Prime Western zinc during the first half of 1946. However, Government subsidies which were continued by Congressional action until June 1947 resulted in a price being paid the mine operators of about 11¼c. per pound. It is estimated that 37% of the domestic mine production was at ceiling prices, compared to 40% and a subsidized price of 11.08c. in 1945. During the OPA "holiday" in July the price rose to 9½c. and stayed there until July 26, at which time, with the reinstatement of OPA, it was rolled back to 8¼c. On Oct. 14 the OPA authorized an increase to 9¼c., and the price remained at that level until Nov. 11, when, with the President's historic proclamation removing ceilings on all items except rent, rice, and sugar, the market rose to 10½c. per pound and remained there for the remainder of the year. The rise to 10½c. for Prime Western zinc brought the domestic price to approximately the level of the world market but still encouraged the export of zinc made from foreign ores owing to the drawback. On the other hand, this price level, plus the premiums paid for high-purity zinc, have encouraged the importation of some high-grade metal, for which the foreign demand is not so great as in the United States. Consequently, it would appear that unless the United States price rises above the world market, we may expect continued exports of bonded material but should continue to receive imports of premium-grades metal.

Europe's Smelters and the Market

It has become increasingly evident that the status of the European smelters will have a marked effect on the world market. During 1946 the world suffered from a shortage of refined zinc. European smelters that formerly produced nearly 50 percent of the world's slab zinc were impeded in their revival by shortage of fuel. There was every indication that the ore supply was sufficient. For example, United States smelters continued to buy concentrates from abroad at domestic prices when the world metal price was above the domestic level. However, European smelter production improved steadily during 1946. Belgium produced in September alone more than 10,000 tons, compared with 4,200 tons for the entire year of 1945, and 34,000 tons for the first six months of 1946. Norway's electrolytic production is practically up to prewar capacity at 3,500 tons a month. France had produced through October more than 25,000 tons, compared with the previous

Table of Production, Shipments and Stocks—1946
(American Zinc Institute)

	(a) Stocks at Beginning	Production	Shipments: Domestic	Shipments: Export and Drawback	Shipments: Gov't Acct.	Shipments: Total	(a) Stock at End	Unfilled Orders at End	Dai'y Avg. Prod.
Jan.	259,391	65,901	47,169	2,326	9,140	58,635	266,657	32,269	2,126
Feb.	266,657	61,274	41,349	886	12,621	54,856	273,075	32,707	2,188
Mar.	273,075	71,612	66,159	2,324	15,210	83,693	260,994	38,168	2,310
Apr.	260,994	60,903	60,809	5,676	6,706	73,191	248,706	39,018	2,030
May	248,706	62,416	60,380	4,120	4,989	69,489	241,633	38,791	2,013
June	241,633	58,812	51,101	2,550	6,841	60,492	239,953	38,230	1,960
July	239,953	59,014	58,321	5,559	5,340	69,220	229,747	39,083	1,904
Aug.	229,747	59,752	43,522	7,678	686	51,886	237,613	41,595	1,927
Sept.	237,613	58,475	60,130	5,323	474	65,927	230,161	42,186	1,949
Oct.	230,161	64,138	71,667	2,248	.....	73,915	220,384	52,694	2,069
Nov.	220,384	66,818	75,749	15,648	.....	91,397	195,805	49,317	2,227
Dec.	195,805	70,097	77,274	12,300	.....	89,574	176,328	58,057	2,261
		759,212	713,630	66,638	62,007	842,275			
Monthly Avg.		63,268	59,469	5,553	5,167	70,190	Daily Average		2,080

(a) Includes Metals Reserve stocks at producers' smelters but exclusive of stocks at other points, amounting to approximately 20,000 tons at the end of the year.

year's production of 8,900 tons and a prewar capacity of nearly 70,000 tons. If the smelter production continues to improve, with consequent satisfying of metal demand, it is reasonable to assume that world zinc prices might recede from present levels, since ore production appears sufficient to take care of smelter requirements.

United States production held up very well during 1946, despite the depressing effect of strikes at some of the smelters and shortage of labor at other smelters and mines. Although lacking the incentive of the war effort, slab zinc production was 759,000 tons for the year, compared with 799,000 tons in 1945. Production was at a particularly high level in the last few months of the year under relatively free-market conditions, rising to 70,000 tons a month, an annual rate of well over 800,000 tons per year. The production available for domestic use was supplemented by withdrawals from the Metals Reserve's stockpile. Through November these stocks had been reduced by about 66,000 tons, slightly more than the 62,000 tons shipped for Government account other than Metals Reserve. There were negligible changes in producers' and consumers' stocks during the year. As 1946 ended, the Civilian Production Administration was freely authorizing releases from stockpile, more than offsetting the quantities being exported. As of Dec. 1, the Metals Reserve stockpile was reported at 187,718 tons of metal comprised of 2,716 tons of Special High Grade, 128,385 tons of Regular High Grade, 4,895 tons of Intermediate, 21,437 tons of Brass Special, and 30,285 tons of Prime Western. In addition to the foregoing quantities, the Metals Reserve Company was holding approximately 300,000 tons of zinc in the form of concentrates at the end of the year.

Consumption of zinc declined during 1946 from the previous year's level. Latest Bureau of Mines reports indicate a consumption of 760,000 tons, whereas 846,000 tons were reported for 1945. The decline was brought about by the decrease in consumption by brass mills, and the inability of the galvanizing industry to maintain the previous year's rate, due chiefly to lack of steel. The galvanizing industry dropped to about 300,000 tons from a 1945 level of 336,000 tons. Brass mills used 130,000 tons—a decline of nearly 50 percent from the previous year. On the other hand, the phenomenal increase in use of zinc by the die-casting industry resulted in a consumption of more than 190,000 tons, against the previous year's rate of 120,000 tons. Estimates for 1947 indicate that this industry's requirements will exceed 260,000 tons of Special High Grade.

Though total zinc production appears ample for all needs, there is a current shortage of certain grades, among them Special High Grade. Other uses of zinc remained practically unchanged in 1946. Rolling mills used between 90,000 and 100,000 tons, and French process zinc oxide is estimated to have accounted for around 20,000 tons.

Shipments to domestic consumers in the closing months of the year were at a peak rate, and, coupled with the export business, were in excess of production. However, as long as the Government appears to be willing to release freely from stockpile, there should be no fear of a shortage in the near future, though certain grades may be in tight supply. Furthermore, in a free market, the domestic price will probably settle at a level which will discourage exports and encourage imports. What this price may be is difficult to predict.

The fate of subsidies after June 30 and the future of the tariff will have a strong bearing on prices. The tariff rates of $\frac{3}{4}$c. on ore and $\frac{1}{4}$c. on metal are due to rise to 1.2c. and 1.4c., respectively, thirty days after the termination of the war emergency. On the other hand, both zinc and zinc ores are on the list of commodities to be considered under reciprocal trade agreements early in 1947. Naturally, any action taken under these agreements would reduce tariffs, counteracting the mandatory rise which will take place with the termination of the emergency. About all that may be said at this time is that present prices, foreign and domestic, appear to be adequate for ample ore production, but will be under pressure until the rehabilitation of foreign smelters and fuller utilization of domestic smelter capacity succeed in making available the metal that the world needs.

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GOLD

Gold production is still low, and the outlook remains clouded because of slowness of world rehabilitation

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FROM BOTH the theoretical and the operating viewpoints, it is not possible to think of gold and the gold-mining industry in 1946 as having emerged very far from the shadows of wartime. With continued confusion in economic and political programs, there was certainly no diminution in markets for the metal. In fact, there was in the United States some return to orthodoxy in economic policies which tended to increase the volume of gold transfers, and this was

hailed as evidence that the world was reverting to its traditional dependence on gold as the settler of international balances. On the other hand, the trend of wages and prices tended to harden against the industry from the viewpoint of recovery costs, and the general position in this respect seemed to be no different from what it was in the difficult transitional period after the first World War. In the mélange of favorable and unfavorable factors the most impressive basic influence seems to have been the perceptible although slight progress made toward settlement of the gravest problems of the peace. The volume of commodity output, however, was so disappointing that not only the countries lacking resources, but those supplied with them in some quantity, were unable to obtain the food, raw materials, and capital equipment they need to begin a proper reconstruction.

Output Up Over Last Year's

Part-year reports on production suggest a total recovery for the world of 22½ million fine ounces, compared with 21½ million ounces last year and 37.1 million ounces in 1940, which was the year of peak output.

There was a sharp rebound in output in the United States, which is explained by the relative severity of the controls imposed here during the war years.

In Canada the chief development of 1946 was the reduction in the price of gold which was incidental to the Government's decision to restore the Canadian dollar to parity in U. S. funds on July 5. This measure was intended to offset the effects of the lapse of price control in the United States on the Canadian economy, which is peculiarly dependent on the United States just at this time for a large volume of imports. In that respect the move seems to have been quite successful and carried with it some benefits to producers in holding down mine costs; however, it came as a shock to them because of the high prices ruling in such special markets as India and the Middle East. Changes in income taxation were made almost simultaneously so as to restore in part the position enjoyed by the industry in prewar years and soften the blow for the regional economies and the investors involved in this very important segment of Canadian producing interest. The real criterion of recovery seems to have been a persistently short labor supply.

The South African industry, which has become increasingly vocal about the effects of rising costs on its generally low-grade production, got some slight encouragement during the year from the British Government's decision last July to purchase South African gold at 172s. 6d. per fine ounce, or 3d. more than had been paid previously, in consideration of lower insurance costs on shipments. The March budget proposals made some changes in taxation also, whereby the special wartime levy of 22½% on profits was removed as of Jan. 1, and in lieu of that the South African Government's formula for general mine taxation was revised upward. On balance, it was estimated that the Government's take from the industry would be reduced by £3,000,000 to approximately £13,650,000. The local picture, however, was not all in a favorable direction. A strike of the European mine workers in the latter half of March seriously affected output. Prospects for profitable operation were still held to be dubious by the Chamber of Mines at the year's end. Orange Free State discoveries are not yet a factor in production.

Western Australia appears to be in a more optimistic position, with volume about 28% higher than 1945 and the Government more openly committed to tax policies which favor development. In the Philippines, rehabilitation of the severe war damage has been going forward, but no mines are yet in production.

In regard to gold prices generally, it may be noted that while the Canadian revaluation is an interesting and probably fortuitous example of what may come out of experience with technical controls gained during the war period, the world price is now less than ever a matter of unilateral action. The International Monetary Fund, which was formally organized during the year, is to begin operating as from March 1, 1947, and the majority of the adhering countries declared as their initial parities the exchange values prevailing on Sept. 12, 1946. By the Fund's acknowledgment, these constitute not much more than the expression of a hopeful attitude among the international experts concerned that they can be made to serve the purposes of stabilization. Some countries invited to adhere to the Fund have been unable, by reason of the peculiarities of their current position, to state their par values. Many of these have been actual war theatres, the governments in which can logically claim that their immediate future is far from clear. Some also are raw-material countries which may suffer greatly from alteration of price relationships between the raw materials they export and the finished goods they need to import. In spite of these defects in the operating structure, however, the beginning of the Fund's operations indicates that belief in currency stabilization as a means of international economic well-being is growing. Excepting Russia, the dominant figures in the world politics are all committed in that direction.

In view of these developments, it has been surprising that so much attention has been devoted during

Gold Production by Principal Reporting Areas Throughout the World

(In millions of ounces)

Principal reporting areas	(a)1946	1945	1940	(d)Percentage Change	
				1945–1946	1940–1946
North America	4.9	3.6	10.2	+33.8	−52.3
United States	1.6	0.9	4.9	+76.2	−66.3
Canada	3.2	2.7	5.3	+19.2	−39.5
Latin America	0.8	0.9	1.1	−11.9	−30.9
Colombia	0.4	0.5	0.6	−16.6	−33.1
Chile	0.2	0.2	0.3	+0.6	−47.5
Nicaragua	0.2	0.2	0.2	−11.0	+14.8
Africa	13.1	13.3	15.8	−1.8	−16.9
Union of South Africa	12.0	12.2	14.0	−2.0	−14.7
Rhodesia	0.5	0.6	0.8	−4.4	−34.3
Gold Coast	0.6	0.5	0.9	+5.9	−35.6
Asia and Oceania	0.7	0.7	1.5	+14.5	−50.5
Philippine Islands	....	....	1.1	.....	−100.0
British India	0.1	0.2	0.3	−23.5	−55.2
Western Australia	0.6	0.5	1.2	+28.3	−49.4
Total reporting areas	19.5	18.5	29.7	+5.3	−34.5
Other countries, excluding U.S.S.R.	(c)3.0	(b)3.0	7.4	.....	−59.4
Total	22.5	21.5	37.1	+4.5	−39.4

(a) Estimate based on incomplete data.
(b) Partly estimated.
(c) Figures carried forward from previous year on assumption that production was probably no lower this year.
(d) Percentage change computed in thousands of ounces.

the year to the provisions written into the Gold Reserve Act of 1934 which permit the Secretary of the Treasury to buy and sell gold at the prices he deems advisable in the public interest. This remnant of early experience with depression psychology of the 'thirties had obviously been permitted to stand as a means of defensive rather than offensive mechanism on the part of the United States in combating currency moves elsewhere, but it has been interpreted as giving the Treasury latitude for changing the gold value of the dollar so as to modify the internal price level.

Apart from the fact that the Treasury acknowledges that the gold value of the dollar has been set by law, there has been general acceptance by experts in and out of the Government that any change in the foreign value of a currency so dominant as that of the United States at the present time would bring on a flood of changes which would serve only to create unsettlement. How a higher gold price could be made to solve the problems of rising price levels has never been made clear. As the lifting of the wartime price controls has demonstrated, the remedy for gold producers as for others lies essentially in greater volume and efficiency of other commodity production.

Although, by reason of restrictions on transfers, the important gold producers have not had access to the markets, high gold prices have continued to prevail in some areas where public sales have been permitted as a means of combating inflation. The Federal Reserve Board believes that since the gold inflow to the United States in the first 12 months following VJ-Day fell short of new foreign gold production by about 300 million dollars, total gold holdings abroad must have increased by that amount plus whatever new gold was mined in Russia. The Board indicates that a large part of this increase was probably absorbed into private hoards in such countries as India, China, Switzerland, and even, closer home, in Mexico.

Gold into Monetary Reserves

In addition to the private hoarding of gold, it appears that some part of new production probably went into monetary reserves. In view of the generally high level of these reserves, it does not seem likely that monetary authorities will be inclined to increase the buying price of gold in the near future. At the end of August, foreign gold reserves were approximately $16 billion, compared with $10½ billion at the end of 1941.

Although some countries have lost significant amounts of gold during the past year and the wartime reserve position of many countries might well be reduced still further because of their great need for goods and services, it now appears that any change will come about much more slowly than was originally believed to be the case because of the delay in the reconversion of industry, particularly in the United States. The large sizes of the monetary gold reserves of foreign countries and the slowness of the reconversion program suggest a fairly stable level for these reserves during the coming year, particularly in view of the considerable cushion which has been provided by recent credit arrangements extended to foreigners by the United States. An additional cushion is provided for in the organizations set up under the Bretton Woods Agreements Act. It is also expected that the plans for the proposed International Trade Organization will be far enough along to indicate what might be expected in this field and to what extent it will affect the distribution of monetary gold reserves.

SILVER

Market weakness follows substantial rise in Treasury price

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THE YEAR 1946 saw American legislation raising the price of silver to a new high level of 90.5c. per ounce for American producers. Temporarily this was also the price for foreign silver, but as the supply situation eased, the price dropped at the end of the year. The long-time position of the metal, however, was weakened by action taken in India and England against the use of an expensive metal for subsidiary coinage; it is not unlikely that other countries may follow suit and that silver's position as a monetary metal will decline, except in the United States.

Silver in Congress

The Green Act of 1943, allowing the sale of Treasury "free silver" to industry at 71.11c. per ounce, expired on Dec. 31, 1945; a bill for renewal had been passed by the House but not acted on by the Senate. Spokesmen for silver users in the House therefore secured the insertion of an equivalent rider on the Treasury-Post Office Appropriation bill. In the Senate, however, supporters of silver producers altered this to make the price 90.3c. for two years and $1.29 thereafter, with seigniorage on the purchase of American newly mined silver at 30% and 0% respectively; abolition of the tax on profits in silver transactions imposed by the Silver Purchase Act of June 1934 was also provided. The bill so amended was passed by the Senate on June 21, but was not acceptable to the House. Finally, a compromise was reached by which the silver provisions were withdrawn from the appropriation bill, and the 1945 House bill was passed, with the selling price raised to 90.5c. and seigniorage on newly mined American silver set at the corresponding 30% but without the provisions for an eventual $1.29 price or for the repeal of the profits tax; this act was signed by the President on July 31.

The Price of Silver

The OPA ceiling kept the New York "official" price at 70⅞c. per ounce 0.999 fine, equivalent to the Treasury buying price for newly mined domestic silver of 71.11c. until the OPA was abolished at the end of June. For the next few days, although that price held for domestic, no price was quoted for foreign silver. On July 10, however, Handy & Harman set a price of 90⅛c. for foreign silver, but discontinued it on July 26, when the OPA had been revived by the act of July 25. On Aug. 1, after the silver act had been

signed and the OPA had authorized a new ceiling of either 90½c. or the Treasury selling price if the latter should be higher (the act authorized the sale at "not less than" 90½c.), Handy & Harman resumed silver transactions with a single price applying to all silver. This was again set at 90½c. and continued, except for a one-day drop to 89c. on Oct. 3, until December, when it dropped to 83¾c. OPA decontrolled the price on Nov. 1 and meanwhile had removed price ceilings from silverware.

The London price remained at 44d. per ounce 0.999 fine during the first seven months of the year, but was adjusted to 55½d. on Aug. 6 as the approximate equivalent of the New York price. During the war, the price and the utilization of silver in London were strictly controlled, and the market was insulated from that in Bombay, where the price was much higher. Beginning in August, however, transactions in London for Bombay were allowed, under authorization in each case from the Treasury and the Board of Trade, provided silver could be purchased outside of the United Kingdom with sterling funds, thus not involving the use of dollars. There thus developed a "free silver" (note a third use of this phrase, in addition to its meaning of free coinage in the 1890's and of unallocated U. S. Treasury stocks in recent years) market, in which supplies from Russia, Spain, and Hong Kong were acquired and shipped to India. The price reflected the Bombay parity, with allowance for shipping, insurance, and import duty; it was usually well above the official 55½d., but fluctuated with changing prospects.

In Bombay, the price had leveled off in the latter part of 1945 at around 133 rupees per 100 tolas (1 tola = 180 grains) fine; with the rupee at about 30c. this was equivalent to $1.07 in New York. In January a rise began which was accelerated by the increase, from Feb. 28, of the import duty on silver from 3.6 annas to 8 annas per fine ounce (equivalent to 18 rupees, 12 annas, per 100 tolas). The rise continued to a peak of 192 rupees in May (equivalent to about $1.54 per ounce) but dropped to 152 rupees in July. In August the duty was reduced by half to 4 annas. The price settled down to between 160 and 170 rupees but in November dropped as low as 126 rupees (equivalent to $1.00 per ounce).

Silver Supply

World statistics on production of silver are incomplete. The following countries, the American Bureau of Metal Statistics reports, accounted for about five-sixths of the world's silver production outside of the unknown Asiatic production. Figures are in troy ounces.

	United States	Canada (a)	Australia (b)	Mexico (c)	Peru (d)
1945.....	29,332,000	12,778,000	7,500,000	60,000,000	16,082,000
1946:					
January.....	2,153,000	1,204,000	528,000	744,000	1,400,000
February....	1,496,000	1,042,000	482,000	826,000	1,100,000
March.....	513,000	1,166,000	498,000	3,514,000	1,200,000
April.....	344,000	1,056,000	600,000	4,632,000	1,300,000
May.....	409,000	1,038,000	620,000	5,012,000	1,300,000
June.....	1,063,000	1,175,000	683,000	5,319,000	1,200,000
July.....	1,395,000	1,266,000	790,000	4,819,000	1,070,000
August.....	2,583,000	1,186,000	585,000	6,102,000	1,150,000
September...	2,993,000	953,000	544,000	4,826,000	1,100,000
October.....	2,940,000	.....	.....	.....	.....

(a) Mostly refined in Canada but includes silver content of products exported. (b) Estimated on basis of lead and copper desilverized in Australia, ex silver in products exported. (c) Estimated in small part; includes silver content of products exported. (d) Partly estimated.

In the first half of the year industrial users were greatly concerned at the shortage of silver. Cases were reported of production being shut down or curtailed for lack of the white metal, and at least one instance of melting silver dollars (cost of silver content, $1.29). Imports of silver were very small, because supplies were being held back in the hope of higher prices. After the passage of the act of July 31, imports from Mexico and other producing countries jumped up, and ample supplies appeared on the market, both domestic and foreign, to meet the needs of industry. Since these supplies were in part from accumulated stocks, this situation is only temporary. Domestic needs are estimated as high as 120 million ounces per year, which is close to the total annual production of North and South America. With United States production free to go either to the Treasury or to industry, if the market price is not below the Treasury price, and with the Treasury free to sell to industry, there should be sufficient silver for industry in 1947.

Treasury Stocks

United States Treasury stocks of silver bullion at the end of 1945 amounted to 1,318 million ounces in the Silver Certificate Reserve and 403 million ounces in the General Fund at cost. During 1946 the quantity in the Reserve was increased to 1,477 million ounces by the completion of the Treasury plan, announced in 1945, of monetizing 300 million ounces from the General Fund. The quantity in the General Fund ("free silver") was reduced by this transfer and also by the use of a considerable quantity for subsidiary coinage, to about 197 million ounces at the end of 1946.

The Treasury had purchased practically no silver since 1942, because all domestic production as well as imports of foreign silver went into industrial uses. When the price was raised to 90.5c. on Aug. 1, the accumulated demand of industry continued to absorb most of the supply, but by the end of the year, when the price of foreign silver had dropped, domestic silver was again being taken by the Treasury. On the other hand, Treasury sales to industry were only nominal, as there was an ample supply in the market.

Announcement was made in August that 475 million ounces of silver used in war plants in non-consumptive functions was commencing to return to the Treasury, but this movement did not proceed very rapidly and there was still 878 million ounces outstanding at the end of December 1946. Of this, about 400 million ounces was in atomic-energy plants, and no announcement was made as to its return. The physical return of this silver will make no difference in the Treasury's supply of "free silver," as the loans are in effect counted as part of the Silver Certificate Reserve. On the other hand, there are outstanding 408 million ounces of silver lend-leased to foreign governments to be returned within five years of the official end of the war; this silver, when received, will be added to the "free silver" in the General Fund.

On the basis of the present gold stock, the Treasury, if it carries out the requirements of the Silver Purcase Act of 1934, will still have to acquire about 2,500 million ounces of the metal.

Silver in Coinage

After the first World War, alarmed by the high price reached by silver in 1920, the United Kingdom and other countries reduced the fineness of their silver coins or replaced them by disks of cheaper metals, and a large quantity of silver from debased or demonetized

coins was dumped on the world market in the 1920's. A similar movement began in 1946. In May the Government of India, which in 1940 had reduced the fineness of the rupee and subsidiary coins from 11/12 to 0.500, decided to withdraw all of the silver subsidiary coins and replace them with coins of a nickel alloy. This move was expected to provide the Government with at least part of the 226 million ounces needed to repay the United States for lend-leased silver. In October, the British Government followed suit with a plan for withdrawing all silver coins and issuing cupronickel substitutes. If all the old coins were recovered they would yield about 220 million ounces, which could be applied toward the repayment of United Kingdom lend-leased silver (88 million ounces), with some margin to aid on the Indian quota and that of Australia (12 million ounces). Thus the British Empire would not have to enter the silver market to purchase supplies at a price considerably higher than when the metal was loaned.

It seems probable that other nations, when reorganizing their currencies, will avoid the use of silver in order not to be at the mercy of a market so susceptible to political forces in the United States.

The United States, as so often in the past, has continued to be an extensive user of silver money. The circulation of both silver dollars and subsidiary silver coins increased greatly during the war and subsequently. The former reached and passed $1 per capita in 1946 for the first time in the history of the country, continuing an upward trend begun in 1933, at a time when the circulation of silver dollars had gotten down to 22c. per capita and when the coin seemed to be on its way out of use. The circulation of subsidiary silver had increased from $2.05 per capita in 1933 to about $6.20 at the end of 1946. These increases are due to the greatly increased national income and business activity, to the increasing number of coin-operated devices which temporarily impound large quantities of coins, and probably to some hoarding of silver money.

Conclusion

A price of around 90c. for silver is probably justified by the present conditions surrounding the production and use of the white metal as well as by the current inflated price level. Whether it is in the long-run interest of silver producers to have the price permanently fixed is doubtful. The decreased monetary use of the metal to which the increased price has led is a bearish factor for the future, and the bullish factor of lend-lease obligations has been largely removed by the same action. The law, of course, provides support for newly mined American silver; the price of foreign silver will depend on the industrial demand, which in turn will reflect general business conditions.

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TIN

Slow rehabilitation of Far Eastern production foreshadows continued shortages —Control agreement not renewed

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PROGRESS toward rehabilitation of the tin industry during 1946 was slow and disappointing. Production from the great tin fields of the Far East did not equal forecasts made earlier in the year. The outputs of Bolivia and the Belgian Congo were below those of the war years. Stocks of metal and concentrates found in areas which had been occupied by Japan, including Japan proper, proved smaller than expected, and much of this tin has not yet been made available for consumption. Exports and imports of tin metal continued under control of the Combined Tin Committee, and consumption in the United States was restricted by Government allocation. World stocks on hand at the end of the war were further reduced.

Table I (p. 85) gives world mine production for 1945-46 and a forecast of production for the years 1947-49. Consumption of virgin tin in the year 1946 was expected to be approximately 136,000 tons (excluding U.S.S.R.), and world stocks at the end of the year have been estimated at 89,000 tons, a reduction of about 42,000 tons. In the ten-year period to 1942, production ranged from a low of 91,000 tons in 1933 to a high of 244,000 tons in 1941. Maximum capacity of world tin mines in 1941 was around 250,000 tons annually. With the loss of the Far Eastern tin fields, normally accounting for two-thirds of world production, the United Nations had available from all other areas only 70,000 to 80,000 tons per year. Even with consumption under strict goverment control, there was a heavy drain on stocks.

Postwar world requirements of tin are estimated at from 175,000 to 200,000 tons annually. If the present forecast proves correct, production and consumption may approach a balance in 1948. After that, supplies should be adequate. This forecast is based on an increase in Far Eastern production from 19,000 tons in 1946 to 129,000 tons in 1948. Such an increase can be accomplished only if rehabilitation of the mines is speeded, if consumer goods are available to native labor, and if many important political and economic conditions are improved.

The United States' position, in so far as it is represented by Reconstruction Finance Corporation's stocks, is tabulated herewith (Table II). Stocks do not include the 12,140 tons of metal held by the Treasury and Navy departments, nor the 9,813 tons of metal which arrived from Japan in the second half of 1946. The Treasury and Navy stocks are not available except for an extreme emergency.

The Japanese tin, most of which is of British or Dutch origin, was brought in under an arrangement with the Far Eastern Commission and consigned to the RFC for weighing, sampling, and sorting. Disposition is subject to allocation by the Combined Tin Committee. The RFC will acquire approximately 4,500 tons of the 5,000 tons declared available for the second half of

(*Continued on page* 84)

MINOR METALS

Relaxation of controls causes price fluctuations. Domestic production recedes sharply except for titanium

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CHARLES WHITE MERRILL, Chief, Metal Economics Division, Economics and Statistics Branch, U. S. Bureau of Mines, Washington, D. C.

RECONVERSION of industry from war to peace and the progressive withdrawal of Government controls explained many of the 1946 trends in production, consumption, stocks, foreign trade, and price for the minor metals. Although hostilities had ended almost five months before, much of the task of reestablishing a peacetime economy still faced the United States when the year opened.

Domestic production of all minor metals except titanium receded sharply in 1946 compared with 1945, and the output of titanium did no more than approach the 1945 level. Outputs of several metals declined to one half or less of the 1945 levels.

Consumption did not experience such large declines in 1946 compared with 1945; beryllium consumption was about the same in 1946 as in 1945 and titanium set on all-time high record. Where production was sharply off, much of the consumption was sustained by drafts on stocks. The decline was general; arsenic stocks at the close of 1946 were the lowest in years.

Imports of mercury in 1946 were only one-fourth those for 1945, but imports of most of the other minor metals either held their own or rose. Rising nationalism, however, threatens access to some foreign sources.

At the beginning of 1946 the OPA exercised control over most of the minor metals through price ceilings, but as the year advanced one ceiling after another was removed, so that all the metals were in a free market before the end of the year. In general, prices rose. Some of them, like those for the platinum-group metals, soared; but mercury, which was already uncontrolled at the beginning of the year, experienced a substantial price recession. There was also a general relaxation of controls by other Government agencies, until at the end of 1946 prewar freedom had been substantially restored.

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ANTIMONY

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SMELTER PRODUCTION of metallic antimony and of antimony oxide and sulphide for the first nine months of 1946 was less than half the total for the previous year. Ores and concentrates were consumed by smelters and manufacturers at a comparable rate. Few data are at hand on mine production, but present indications are that domestic output will be somewhat greater than the 1,900 tons shipped in 1945. The Bradley Mining Co. resumed operations at its antimony-gold deposit in Idaho about the middle of the year.

Imports of antimony contained in ore totaled less than 4.500 tons, just 25% of the quantity received in the first nine months of 1945, but receipts of metal increased threefold to more than 2,000 tons. Mexico regained its lead as a source of ore; it was second to Bolivia in 1945. Metal was also shipped from both China and Japan but was doubtless of Chinese origin.

Industrial consumption of primary antimony was nearly 12,000 tons, about half the total for 1945. A marked change in the use pattern is noted, about 8,000 tons having been consumed in the manufacture of metallic products and nearly 4,000 tons for nonmetallic products, whereas during the war years this ratio was about 50:50. Use of antimony oxide in flameproofing compounds dropped to 68 tons, compared to 7,675 tons in 1945. Production of frits and sodium antimonate nearly doubled, and output of type metal increased.

OPA prices for ore and metal remained in effect until Nov. 12, and on that date quotations for the metal rose from 14.5 to 23.5¢ a pound, in bulk carlots, f. o. b. Laredo, Texas. The leading domestic producer announced a further increase of 4.75¢ effective Dec. 18, making the comparable current price 28.25¢ a pound.

Government stocks of antimony contained in ore and as metal declined from 10,237 tons at the first of the year to 4,839 tons on Sept. 30. These stocks consisted of 3,085 tons of metal and 1,754 tons in ore at the end of the third quarter, compared to 2,554 tons of metal and 7,592 tons in ore at the beginning of the year. Mine stocks were about 800 tons of antimony contained in ores and concentrates on Sept. 30, compared to 3,364 tons at the first of the year.

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ARSENIC

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DOMESTIC OUTPUT of crude and refined white arsenic in 1946 will be about 11,000 short tons, compared with 24,349 tons in 1945 and 36,094 tons—an all-time peak—in 1944.

General imports of 10,908 short tons during the first nine months of 1946 matched almost exactly those for the previous year. Sources of these imports were about the same—Mexico well in the lead, followed by Peru. Canada continued to supply a small portion of

the total, and for the first time in several years arsenic was received from Sweden. Export data on white arsenic are not available, but exports of calcium and lead arsenates were at about the same level as in 1945.

No Governmental control of arsenic consumption has been in effect since Schedule 46 of WPB General Allocation Order M-300 was revoked on Aug. 11, 1945. Control of prices was relinquished in midyear, and effective July 8 sellers raised the price of white arsenic 25%, to 5¢ a pound in carlots.

The last of the Government stocks of arsenic and of "unprocessed" material were disposed of in March. Stocks of white arsenic held by producers had practically disappeared by the end of August, compared to about 2,300 tons at the beginning of the year. Stocks of arsenates, particularly calcium arsenate and paris green, were the lowest in many years, indicating that next season's demand will have to be met from 1947 production and imports.

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BERYLLIUM

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DEMAND for beryllium-copper in 1946 appears to have equaled that of 1945 and doubled that of any year prior to 1941. Consumption of beryl was estimated at 1,700 short tons, supplied predominately by new imports and partly by drafts on Government stocks. Domestic pegmatites contributed negligible quantities.

Imports of beryl in the first nine months of 1946 totaled 1,088 tons—896 from Brazil, 119 from India, 53 from Argentina, and 20 from Australia—compared with 1,148 tons that was brought in in the same period of 1945.

The future availability of beryl has become a matter of some concern. Depletion of currently workable deposits in Argentina and Australia is diminishing shipments from those areas, and nationalistic policies are blocking other sources; for example, India placed an embargo on beryl in June 1946, and France permits Madagascan beryl to move only to the mother country. In Germany at the end of the war was a stockpile of about 500 tons of beryl, some of which is being delivered to France.

Government stocks of beryl which were in the possession of the Office of Metals Reserve during 1946 declined from 4,497 short tons on Jan. 1 to 4,118 tons on Sept. 30 last.

The price of domestic beryl, 8 to 12% BeO, f. o. b. mines, was nominally quoted at $8 to $10 a short-ton unit of BeO during 1946, but a higher price would doubtless have been paid, particularly later in the year, for any sizable lot offered. Foreign beryl, delivered consumer's plant, was listed at $10 to $11 per unit for 8 to 10% BeO early in 1946, $10.39 to $12.39 for 10 to 12% BeO from mid-March to mid-November, and $13.50 to $15.50 late in the year. Thus, as a result of unfavorable availability factors, the price of beryl is now about four times its prewar level. The price of beryllium-copper master alloy was reduced in February 1946 from $15 to $14.75 per pound of contained beryllium.

BISMUTH

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DOMESTIC PRODUCTION of metallic bismuth during the first nine months of 1946 was about 55% of the output for the same period in the previous year, and it is estimated that total production for the year will be about two-thirds that of 1945. This decline in production was offset by a small increase in net imports, a drop of 25% in consumption, and a net drain of 175,000 lb. from Government stocks.

Imports totaled more than 350,000 lb., compared to 243,000 lb. for the first nine months of 1945, but exports increased from 45,000 to 145,000 lb. in the same period. All the imported metal came from Peru except 30,000 lb. brought in from Canada.

The Government has exercised no controls over consumption for more than a year but maintained a maximum ceiling price until July 1946. Effective July 8 the price advanced from $1.25 a pound, at which level it had been since October 1939, to $1.60, and this was further increased to $1.80, effective Dec. 2.

Use of bismuth in the manufacture of chemicals, mostly pharmaceuticals, increased 2% to 620,000 lb. during the first three quarters of the year. Its use in metallic products fell 54%, to 343,000 lb.

Government stocks Sept. 30 were 587,475 lb., compared to a total of 762,829 on Jan. 1, 1946. Industry stocks also showed a sharp decline.

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CADMIUM

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PRODUCTION of cadmium, like that of all the non-ferrous byproduct metals, suffered from the manpower shortage, strikes, and postwar readjustments. Figures available on output for only the first half of 1946 indicate a rate of production well below that of the first half of 1945. However, the sharp climb in zinc production beginning in August was no doubt followed by a roughly parallel increase in cadmium output. It is estimated that the production of primary metallic cadmium for the year will be about 20% less than the 7,900,000-lb. figure reached in 1945. Data on production of primary cadmium compounds are incomplete, but the total for 1946 will probably be well above that of 1945.

The OPA ceiling price of 90¢ a pound for commercial sticks and 95¢ for patented shapes remained in effect until July 8, when a 35¢ increase was quoted. This level was maintained until Nov. 12, on which date a further increase of 25¢ became effective.

Imports of flue dust were below the 1945 rate, but receipts of metal were about the same as in that year. Mexico continued to be the main source of dust, but one small lot was received from the Netherlands.

Government stocks on Oct. 31 were 602,109 lb. of metal, about one-third less than the 907,425 lb. available at the beginning of the year.

MERCURY

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DURING THE POSTWAR reconversion period thus far mercury supplies in the United States have been abundant in contrast with shortages for most other mineral commodities.

Mercury production, consumption, and imports in 1946 were considerably below World War II peak levels, but the total for each was much larger than in 1939. Data based on figures for three-quarters of the year indicate that production for the full year will be close to 23,000 flasks, or 25% below 1945 and less than one-half the World War II peak of 51,929 flasks in 1943.

Consumption of the metal was less than one-half of the historic peak of 63,900 flasks in 1945. General imports were sharply reduced in 1946 and probably would total about 25% of the all-time record (established by a substantial margin) of 71,508 flasks in 1945. In relation to 1939, production in 1946 was about 23% higher, consumption 45% and imports more than 160% higher.

United States production surged forward after the outset of World War II, following the sharp price mark-up, and on an annual basis was large enough to take care of domestic requirements through 1943. With a falling price, production lagged behind consumption in 1944, and did not revive in response to the consumption and price gains of 1945. Imports, however, did reach spectacular heights in 1945, and this factor, together with the end-of-war demand for the new-type dry-cell battery, brought inventories to heights never previously attained. As a result of the foregoing situation the monthly price of quicksilver for December 1945 was 31% less than in January.

Whether the new-type dry cell will diminish the present oversupply of mercury is still a question, although production of cells for several types of military batteries and for hearing-aid use is under way. Work has been concentrated on the development of new designs and on more economical manufacture, and noteworthy progress is reported. Likewise substantial business in 1947 is anticipated.

The fact that production and imports together probably exceeded consumption by more than 10,000 flasks, plus attempts of Spanish and Italian producers to market additional quantities of metal in the United States, led to a price recession, but the average quotation of $105 in January had fallen only to $89 in November, at which level it continued in early December. No more than a half dozen domestic mines are believed to have been active in December 1946, compared with nearly 200 in operation in 1941 and 1942.

The situation in regard to stocks in 1946 can be given only in part. At the beginning of the year the Office of Metals Reserve held 63,638 flasks, consumers and dealers 17,000 (of which part was scheduled for the permanent stockpile), and producers 3,243 flasks. During the first quarter Metals Reserve stocks dropped to 21,595 flasks, consumers' and dealers' inventories fell to 10,900, and producers' to 2,949 flasks. By the end of 1946 Metals Reserve stocks had dropped to 20,884 flasks, but industry metal was higher by several thousand flasks. The apparent over-all drop in stocks in 1946, despite an oversupply of metal, is explained largely by the transfer of mercury into the permanent stockpile, the size of which is not made public.

More than 8,000 flasks from surplus European stocks, actually mercury from conquered territory, threatened the domestic market for a time but were purchased ultimately by a domestic company for resale abroad.

Spain produced 14,100 flasks of mercury in the first half of 1946 and Mexico 6,239 flasks; Italy produced 10,530 flasks in the first quarter of the year. Later figures are not available. The maximum price order was revoked by the British Government in August, but the Ministry of Supply continued temporarily as sole importer and distributor of mercury. The maximum control price in London was £30 to £31 5s. per flask (more than $120) when the control was removed. In November the importation of mercury passed into private hands and metal for forward delivery was reported available at £20 10s. ($82.50).

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COBALT

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ALTHOUGH DEMAND for cobalt in 1946 was substantially less than during World War II, the prewar peacetime upward trend in usage had projected itself into the first postwar year. The quantity of cobalt used annually, however, is relatively small compared to nickel, a metal it resembles. Nevertheless, because of the unusual properties of cobalt it is likely that its peacetime demand will expand steadily.

Consumption of cobalt (exclusive of salts and driers) by industrial consumers was 2,237,078 lb. during the first nine months of 1946, compared with 3,710,887 lb. during the entire year 1945. The largest single use for cobalt during 1946 was for magnets and magnet steel, which accounted for 45% of the total quantity consumed during the first nine months; moreover, usage for these purposes during this period was only 9% less than for the entire year 1945. Substantially more cobalt was used in ground-coat frit and pigments in 1946 than in 1945.

Consumption of cobalt contained in alloy and ore by refiners and processors was 1,333,245 lb. during the first nine months of 1946, compared with 4,808,825 lb. during the entire year 1945.

Despite the fact that the United States is the largest consumer of cobalt in the world, only a small part of its requirements comes from domestic ore. The Bethlehem Steel Co., Bethlehem, Pa., and the St. Louis Smelting & Refining Co., Fredericktown, Mo., were the only producers of commercial cobalt ore in the United States in 1946; output was much less than in 1945.

Imports of cobalt into the United States during the first nine months of 1946 were substantially less than during the corresponding period of 1945. The 1946 imports comprised 824 short tons of Belgian Congo alloy containing 717,337 lb. of cobalt; 220 tons of Canadian ore containing 50,067 lb. of cobalt; 1,027,532 lb. of metal; and 617,780 lb. (gross weight) of oxide. Most (777,420 lb.) of the metal and virtually all (617,130 lb.) of the oxide came from Belgium. The

remainder (250,112 lb.) of the metal came from Belgian Congo; the United Kingdom supplied 650 lb. of oxide.

Exports of cobalt are small, and during the first nine months of 1946 comprised 14,533 lb. of metal and alloy and 1,509 lb. of ore and concentrates. Some oxide was also exported, but the quantity is not known.

Effective June 12, 1946, price control over cobalt was removed by the OPA. Despite this removal, however, metal containing 97 to 99% cobalt remained unchanged at the former ceiling price of $1.50 to $1.57 a pound.

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PLATINUM METALS

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SUSPENSION of ceiling prices on the six platinum-group metals by the OPA on April 29, 1946, followed by greatly advanced quotations for platinum, osmium, and ruthenium, was a feature of the platinum industry in 1946. By Sept. 16 platinum and ruthenium had risen from their former ceiling price of $35 an ounce to a peak of $93, and osmium had been raised to $100, up $25. Iridium, usually more sensitive to supply-and-demand rumors and to speculation than any of the other platinum metals, was advanced on June 27 from $95 to $100 an ounce to $125, which, however, was $40 less than the OPA fixed price. Insufficient supplies, active demand, and speculation stimulated higher prices. Coincident with improvements in the supply-and-demand position, several price reductions were made on platinum and ruthenium, and by mid-December platinum had dropped to $60 an ounce wholesale and $65 retail, and ruthenium had been lowered to $70. Iridium remained at $125 an ounce until Oct. 24; thereafter it fluctuated between $130 and $110. Quotations on palladium and rhodium remained stable at $24 and $125 an ounce, respectively, throughout 1946.

Refining of platinum in the United States was at a much lower rate (47%) during the first nine months of 1946 than in the corresponding period of 1945 and was greatly insufficient for the demand, which, however, was substantially less than in 1945. The deficiency was met chiefly by imports and by the release of some Government stocks. The jewelry trade was by far the largest outlet for platinum in 1946, taking 64% of the total sold during the first nine months. More platinum was sold to the jewelry trade in 1946 than in any previous year. The record sales to the jewelry trade, however, were more than offset by phenomenal declines in demand by the chemical and electrical industries, resulting in total sales of only 178,000 oz. in the first nine months of 1946, a 35% drop from the corresponding period of 1945. Imports of refined platinum from abroad during the first nine months of 1946 were 80,591 oz. and exports were 11,468 oz.

Refining of palladium during the first nine months of 1946 was at a rate about 60% under 1945 and was only one-eighth of sales (153,000 oz.), which were 16% greater than during the corresponding period of 1945. The smaller recovery by domestic refiners was supplemented by imports of 144,729 oz. of refined palladium during the first nine months. The electrical industry was again the largest user of palladium and was also chiefly responsible for the gain in total sales, but demand by the jewelry trade, the second largest outlet, continued at a high level.

Both refining and consumption of the other platinum metals—iridium, rhodium, osmium, and ruthenium—were comparatively small. Imports of these metals during the first nine months of 1946 were 10,771, 300, 1,122, and 5,736 oz. respectively. Iridium and ruthenium, hardening additions for platinum and palladium, were in much demand by the jewelry trade.

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TITANIUM

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CONSUMPTION of ilmenite reached a record high in 1946 of approximately 400,000 short tons, primarily as a result of a demand for titanium pigments as great or greater than during the war. Pigment producers were unable to fill all orders because of a shortage of capacity, but this situation is expected to be eased in 1947 by the expansion programs of three titanium dioxide producers. Although consumption of rutile declined to about 7,000 tons, less than half the 1943 peak, it was almost triple the rate which was attained in 1936-39.

Domestic production of ilmenite in 1946 was about 278,000 short tons, equal to that of 1944 and 10% less than in the peak year 1945. Rutile production in the United States reached about the same high level as in 1945 and equaled consumption for the first time since the industry's infancy.

Imports of ilmenite during the first nine months of 1946 were 224,524 short tons. Indian entries comprised 93% of the total but ceased at mid-year as a consequence of Travancore State efforts to establish a local pigment industry, and may not be resumed unless mine production expands substantially. Imports of rutile (all from Australia) in the first nine months of 1946 receded to the lowest level that they have reached since 1940.

Stocks of ilmenite and rutile could support domestic requirements for a year at the current rate of consumption, assuming no new supply becomes available to the market.

Ilmenite, 60% TiO_2, f. o. b. Atlantic seaboard, was nominally quoted at $28 to $30 a long ton in the first five months of 1946; the grade was specified as 57 to 60% and the price was reduced to $24 to $26 in June and to $22 to $24 in November. Rutile, 94% TiO_2, was nominally quoted at 8 to 10¢ a pound throughout the year, although the actual sales price probably averaged nearer 6¢.

E & M J Me

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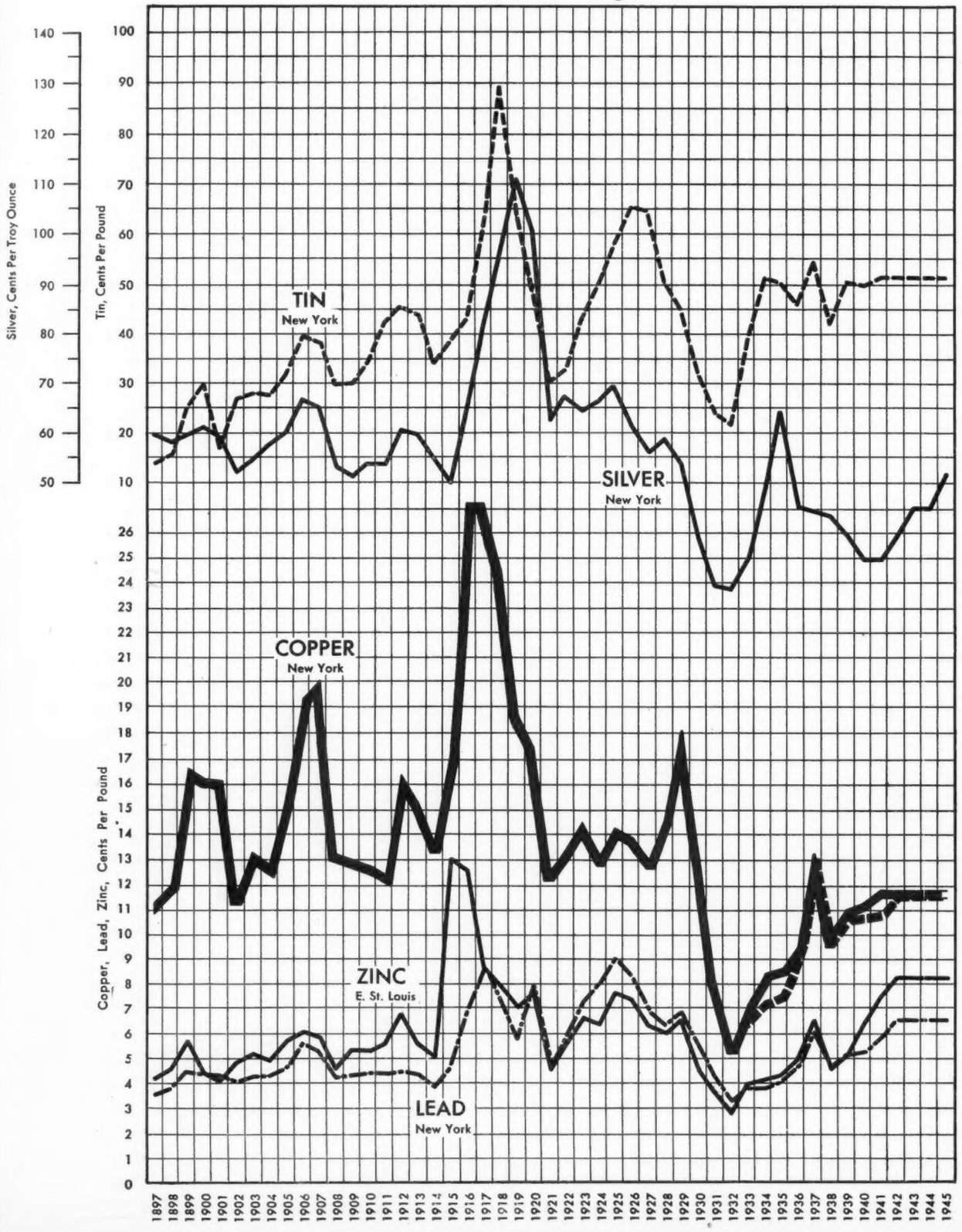
Annual Averages



Metal Prices

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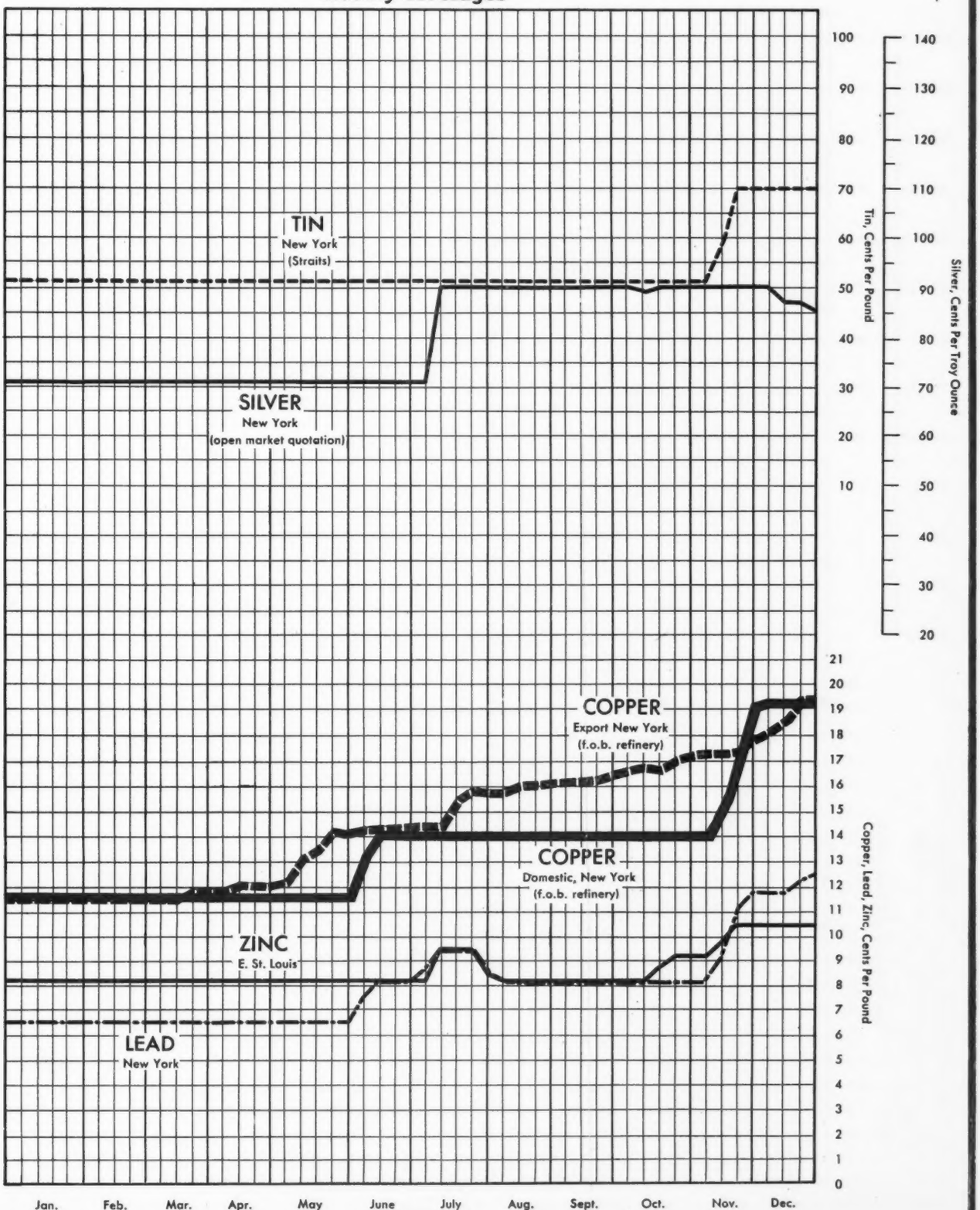
Weekly Averages



1944
1945

E & M J Annual Average Metal Prices--1897 to 1946

Year	Copper (a) Electrolytic Refinery	Lead Common, New York	Zinc, Prime Western (b) E. St. Louis	Tin, (c) New York	Silver, (e) New York
1897.....	11.29	3.580	4.120	13.67	59.790
1898.....	12.03	3.780	4.570	15.70	58.260
1899.....	16.67	4.470	5.750	25.12	59.580
1900.....	16.19	4.370	4.390	29.90	61.330
1901.....	16.11	4.330	4.070	16.74	58.950
1902.....	11.626	4.069	4.840	26.79	52.160
1903.....	13.235	4.237	5.191	28.09	53.570
1904.....	12.823	4.309	4.931	27.99	57.221
1905.....	15.590	4.707	5.730	31.358	60.352
1906.....	19.278	5.657	6.048	39.819	66.791
1907.....	20.004	5.325	5.812	38.166	65.237
1908.....	13.208	4.200	4.578	29.465	52.864
1909.....	12.982	4.273	5.352	29.735	51.502
1910.....	12.738	4.446	5.370	34.123	53.486
1911.....	12.376	4.420	5.608	42.281	53.340
1912.....	16.341	4.471	6.799	46.096	60.835
1913.....	15.269	4.370	5.504	44.252	59.791
1914.....	13.602	3.862	5.061	34.301(d)	54.811
1915.....	17.275	4.673	13.054	38.590	49.684
1916.....	27.202	6.858	12.634	43.480	65.661
1917.....	27.180	8.787	8.813	61.802	81.417
1918.....	24.628	7.413	7.890	88.750	96.772
1919.....	18.691	5.759	6.988	63.328	111.122
1920.....	17.456	7.957	7.671	48.273	100.900
1921.....	12.502	4.545	4.655	29.916	62.654
1922.....	13.382	5.734	5.716	32.554	67.528
1923.....	14.421	7.267	6.607	42.664	64.873
1924.....	13.024	8.097	6.344	50.176	65.781
1925.....	14.042	9.020	7.622	57.893	69.065
1926.....	13.795	8.417	7.337	65.285	62.107
1927.....	12.920	6.755	6.242	64.353	56.370
1928.....	14.570	6.305	6.027	50.427	58.176
1929.....	18.107	6.833	6.512	45.155	52.993
1930.....	12.982	5.517	4.556	31.694	38.154
1931.....	8.116	4.243	3.640	24.467	28.700
1932.....	5.555	3.180	2.876	22.017	27.892
1933.....	7.025	3.869	4.029	39.110	34.727
1934.....	8.428	3.860	4.158	52.191	47.973
1935.....	8.649	4.065	4.328	50.420	64.273
1936.....	9.474	4.710	4.901	46.441	45.067
1937.....	13.167	6.009	6.519	54.337	44.883
1938.....	10.000	4.739	4.610	42.301	43.225
1939.....	10.965	5.053	5.110	50.323	39.082
1940.....	11.296	5.179	6.335	49.827	34.773
1941.....	11.797	5.793	7.474	52.018	34.783
1942.....	11.775	6.481	8.250	52.000	38.333
1943.....	11.775	6.500	8.250	52.000	44.750
1944.....	11.775	6.500	8.250	52.000	44.750
1945.....	11.775	6.500	8.250	52.000	51.928
1946.....	13.820	8.109	8.726	54.544	80.151

(a) Lake copper 1897–98; domestic copper since 1932. (b) New York zinc 1898–1902. (c) 99 percent tin 1897 to 1920, inclusive; Straits quality thereafter. (d) Average for eleven months. (e) New York Official. All quotations in cents per pound, except for silver, which are in cents per troy ounce.

E & M J Weekly Average Metal Prices—1946

Week Ended	Copper Domestic Refinery	Copper Export Refinery	Lead New York, Common	Zinc E. St. Louis, Prime Western	Tin New York, "Straits"	Silver New York Official
Jan. 2...	11.775	11.700	6.500	8.250	52.000	70.750
9...	11.775	11.700	6.500	8.250	52.000	70.750
16...	11.775	11.700	6.500	8.250	52.000	70.750
23...	11.775	11.700	6.500	8.250	52.000	70.750
30...	11.775	11.700	6.500	8.250	52.000	70.750
Feb. 6...	11.775	11.700	6.500	8.250	52.000	70.750
13...	11.775	11.700	6.500	8.250	52.000	70.750
20...	11.775	11.700	6.500	8.250	52.000	70.750
27...	11.775	11.700	6.500	8.250	52.000	70.750
Mar. 6...	11.775	11.700	6.500	8.250	52.000	70.750
13...	11.775	11.700	6.500	8.250	52.000	70.750
20...	11.775	11.942	6.500	8.250	52.000	70.750
27...	11.775	11.954	6.500	8.250	52.000	70.750
April 3...	11.775	11.996	6.500	8.250	52.000	70.750
10...	11.775	12.154	6.500	8.250	52.000	70.750
17...	11.775	12.137	6.500	8.250	52.000	70.750
24...	11.775	12.133	6.500	8.250	52.000	70.750
May 1...	11.775	12.292	6.500	8.250	52.000	70.750
8...	11.775	13.200	6.500	8.250	52.000	70.750
15...	11.775	13.617	6.500	8.250	52.000	70.750
22...	11.775	14.217	6.500	8.250	52.000	70.750
29...	11.775	14.192	6.500	8.250	52.000	70.750
June 5...	13.200	14.254	7.550	8.250	52.000	70.750
12...	14.150	14.413	8.250	8.250	52.000	70.750
19...	14.150	14.433	8.250	8.250	52.000	70.750
26...	14.150	14.483	8.250	8.250	52.000	70.750
July 3...	14.150	14.550	8.750	8.250	52.000	70.750
10...	14.150	14.567	9.500	9.500	52.000	.....
17...	14.150	15.596	9.500	9.500	52.000	90.125
24...	14.150	15.963	9.500	9.500	52.000	90.125
31...	14.150	15.925	8.458	8.458	52.000	90.125
Aug. 7...	14.150	15.925	8.250	8.250	52.000	90.125
14...	14.150	16.042	8.250	8.250	52.000	90.125
21...	14.150	16.096	8.250	8.250	52.000	90.125
28...	14.150	16.217	8.250	8.250	52.000	90.125
Sept. 4...	14.150	16.288	8.250	8.250	52.000	90.125
11...	14.150	16.354	8.250	8.250	52.000	90.125
18...	14.150	16.404	8.250	8.250	52.000	90.125
25...	14.150	16.596	8.250	8.250	52.000	90.125
Oct. 2...	14.150	16.817	8.250	8.250	52.000	90.125
9...	14.150	16.950	8.250	8.250	52.000	89.900
16...	14.150	16.883	8.250	8.350	52.000	90.125
23...	14.150	17.133	8.250	9.250	52.000	90.125
30...	14.150	17.413	8.250	9.250	52.000	90.125
Nov. 6...	14.150	17.425	8.250	9.250	52.000	90.125
13...	15.400	17.427	9.150	9.750	59.200	90.125
20...	17.468	17.467	11.150	10.500	70.000	90.125
27...	19.146	17.908	11.800	10.500	70.000	90.125
Dec. 4...	19.275	18.154	11.800	10.500	70.000	90.125
11...	19.275	18.771	11.800	10.500	70.000	87.550
18...	19.275	19.425	12.175	10.500	70.000	87.150
25...	19.275	19.500	12.550	10.500	70.000	85.625

1946. Actual purchase is awaiting sorting and recording of identification marks. This tin was, according to plan, to be added to RFC's stocks in December 1946 or January 1947. The remainder of the Japanese tin, approximately 4,813 long tons, probably will be available for allocation during the first half of 1947.

Preliminary figures indicate that 1946 consumption of tin in the United States was about 60,000 long tons —approximately 58,000 tons being supplied by the RFC and the rest by plants producing refined tin from secondary materials. An additional 21,000 tons, derived from scrap and secondaries, was marketed in the form of tin alloys. Consumption of primary tin, restricted by Government allocation, was further curtailed during 1946 by strikes in essential industries.

Requirements of primary tin for 1947, on an unrestricted basis, are estimated at 85,000 to 90,000 long tons, without allowance for replenishing consumer stocks. The available supply will consist of 36,000 to 40,000 tons of Longhorn tin produced by the Texas City smelter, and purchases of tin metal produced abroad as allocated by the Combined Tin Committee. The amount of such allocation no doubt will be determined by foreign smelter production. If present production forecasts are realized, United States consumers may expect a larger quantity than in 1946. As private stocks in the United States probably are 10,000 to 15,000 tons below normal, taking into account the absence of brokers' stocks which in prewar years averaged around 5,000 to 6,000 tons, the Government must maintain a stock to supply part of the country's working inventory. Economic and political uncertainties throughout the world, especially in tin-producing areas, indicate a need for continued restraint in using tin.

Regional Developments

Malaya. Rehabilitation was retarded in 1946 by delays in obtaining equipment and parts, by labor shortage and by scarcity of food, clothing, and other essentials for native workmen. The latest reports still emphasize these problems. Failure of the Government to decide upon a method of compensation for war damage to mining properties also delayed rehabilitation.

Netherlands East Indies. The Dutch have made good progress toward restoration of production. Fortunately, political disturbances on the larger islands did not directly involve the small tin-producing islands of Billiton, Banka, and Sinkep. Reoccupation, however, was delayed by the general unrest throughout the East Indies.

Of the 23 dredges operating before the war, 10 were working by the end of 1946; another 5 are scheduled to begin operation in the first half of 1947; and the rest, except for 2 which were completely destroyed, should be producing in the latter part of 1947 or early in 1948. Eight new dredges have been ordered, two from the United States and six from Holland.

Siam. Tin mining in Siam was practically at a standstill during 1946, awaiting settlement of the British reparation claims against Siam.

Bolivia. Tin production reached a wartime high of 42,480 tons in 1945, but latest figures for 1946 indicate only 38,000 tons. The drop is attributed to higher costs, lower grade of ore, and a deficiency in development work. Reserves of ore, especially low-grade ore, are considered large—sufficient to maintain an annual output of 40,000 tons (tin content) for a number of years—but production is likely to drop further unless the price of tin remains high or costs can be reduced.

Belgian Congo. Production was expanded from less than 10,000 tons before the war to 17,000 tons in 1944. This rate cannot be maintained by existing operations, and output for the next few years is not expected to be more than 14,000 tons annually. An exploration program has been planned.

Table I. Estimated World Mine Production of Tin

(Long Tons Tin Content)

Countries	1945	1946	1947	1948	1949
Malaya	3,100	9,000	38,000	65,000	73,000
N.E.I.	1,000	6,000	26,000	46,000	50,000
Siam	1,500	1,500	5,000	10,000	15,000
China	2,500	2,500	4,000	8,000	12,000
Nigeria	11,200	11,500	11,000	11,000	11,000
Congo	17,500	13,000	12,000	14,000	14,000
Bolivia	42,500	38,000	40,000	40,000	40,000
All others	9,700	9,500	11,000	13,000	15,000
Totals	89,000	91,000	147,000	207,000	230,000

Texas City Smelter

The Government-owned smelter at Texas City, Tex., continued in 1946 to supply the major part of tin metal consumed in the United States. Production for the full year will approximate 43,500 tons, compared with 40,590 tons in 1945. During the year operating efficiency was further improved. However, production in 1947 may be somewhat less, because of treatment of lower-grade ore and a larger proportion of low-grade secondaries which were stored during the construction period.

Stocks of high-grade Netherlands East Indies ore, accumulated prior to 1942, were exhausted in 1945, and contracts for African alluvial ores expired in 1946. The African ores now go to European smelters. Remaining stocks of high-grade Patiño ore, which had been diverted to the United States in 1945, will be smelted early in 1947. The 1947 ore supply for the smelter is expected to come from Bolivian producers other than Patiño, from N.E.I., Siam, and present smelter stocks. Bolivia may furnish from 18,000 to 20,000 tons of tin in ore, N.E.I. 7,500 tons, and Siam possibly 5,000 tons.

The Texas City tin smelter has been of tremendous value to the United States during the war and during reconversion. It supplied more than 50% of the new tin used by the United States during the war period—metal which would have been difficult, if not impossible, to obtain from any other source. Its operation has been equally important during reconversion, furnishing about 70% of our tin supply. The smelter production will be essential during 1947, and possibly during 1948. By the end of 1948, foreign smelters again may be able to furnish our tin requirements. Therefore a program for the continued operation of the smelter should be decided during 1947. There can be no question about the desirability of having a commercial tin-smelting industry in the United States. Every effort should be made to establish the Texas City smelter as a sound commercial enterprise under

private operation, even though some Government assistance may be required at the start.

One of the most important problems is an adequate ore supply at a price comparable to that paid by other tin smelters of the world. Presumably, we can obtain the low-grade Bolivian ore which formed our principal supply during the war. However, much of this ore comes from high-cost mines which cannot operate profitably during periods of low tin prices. In addition to low-grade ore, the smelter should have a supply of high-grade alluvial ore. The Dutch and British have ample smelting capacity to treat their entire mine production. Diversion of ore to this country would mean loss of smelting profit to them. Though this presents a difficulty, it does not necessarily preclude long-term ore contracts with Texas City. A contract has recently been signed for one-quarter of the 1947 N.E.I. production plus an additional 1,000 tons of tin in concentrates on hand from 1946 operations.

Siam is a promising source of high-grade ore (*E.&M.J.*, Dec., 1946, p. 60), particularly if American mining companies become interested in the exploration and development of mineral resources in that country. Recently Siam announced that all of the country would be open for mineral development—a large part previously having been reserved. China also may become a source of ore, although in the past only tin metal has been exported.

The Texas City smelter has the disadvantage of a much higher wage rate than that under which foreign smelters operate. This is offset to some extent by cheaper fuel and acid. Maximum use of labor-saving equipment is essential. An advantage of Texas City is that its entire tin output can be sold in the United States, whereas most foreign smelters must find an export market for a large part of their production. Before the war, tin in concentrates could be transported by ocean vessel about as cheaply as tin metal.

Table II. RFC Tin Position
Stocks, Receipts, Sales—1946 to Nov. 30

(Long Tons Tin Content)

Metal		
Stocks, 1/1/46		25,648
Imported tin metal, Jan. 1–Nov. 30, 1946		6,398
Texas City smelter production, Jan. 1–Nov. 30, 1946		40,258
Total available		72,304
Sales, Jan. 1–Nov. 30, 1946		
Longhorn tin	45,031	
Foreign tin	7,158	52,189
Stocks 12/1/46		20,115
Concentrates		
Stocks 1/1/46		42,638
Deliveries, Jan. 1–Nov. 30, 1946		29,517
Total available		72,155
Smelted, Jan. 1–Nov. 30, 1946		41,269
Stocks 12/1/46		*30,886
Metal and concentrates		
Stocks 1/1/46		68,286
Stocks 12/1/46		51,001
Reduction in stocks Jan. 1–Nov. 30, 1946		17,285

* Includes material in process at the smelter, in transit, and stored abroad.

Price and International Control

Two significant events affecting the tin industry took place during 1946: Tin prices in the principal consuming and producing countries were adjusted so that a reasonable relationship now exists, and the International Tin Agreement, which expired Dec. 31, 1946, was not renewed.

The British, on Sept. 26, increased the price of tin for both domestic sales and exports to £380 10s. per long ton for English Standard grade. The price to English consumers had been £300 and to the export market to £365. At the same time a price of £372 was established for Straits tin, ex Malayan smelters. These new prices were based on the price paid by the RFC for Bolivian concentrates during the second half of 1946.

The United States removed price controls on all metals on Nov. 10. RFC then increased its selling price for Grade A tin from the long outdated ceiling price of 52c. per pound to 70c. This is approximately equivalent to the £372 Malayan price for Straits tin plus delivery charges to New York.

The International Tin Agreement, under which the International Tin Committee operated, was allowed to expire. This decision was the result of the world conference on tin held in London last October. Delegates to the conference, representing the eight principal countries interested in the production and consumption of tin, agreed to recommend to their governments the formation of an international tin study group. The study group would maintain a review of the world tin situation and recommend to participating governments appropriate action to deal with problems affecting the tin industry.

The International Tin Control Agreement first became operative in February 1931, and was renewed three times, the last extension covering the period from September 1942 to Dec. 31, 1946. During the war years the committee ceased to function except for the collection of statistics and certain research work. In prewar years it was an effective instrument for maintaining a balance between production and consumption, and thereby influencing prices.

Opinion among producing, countries on termination of the agreement was by no means unanimous, and those favoring continuation might have been more aggressive except that no overproduction is expected for another two or three years.

The United States, which consumes more than 40% of the world's tin production, has a definite interest in contributing to the success of the international tin study group. As an important member of this organization, it can influence decisions which might affect production, stocks, and prices. It is interested in a production rate which will permit accumulation of tin for the permanent stockpile, in securing tin ores for the Texas City smelter, and in having adequate working stocks for industry. Even more, this country is interested in stable prices at reasonable levels. These objectives need not be inconsistent with the best interests of the producing countries. However, the study group must prove that it can act promptly and effectively when production problems arise, or some of the producing countries undoubtedly will attempt to revive the International Tin Control Agreement.

FERRO-ALLOYS

Outlook is for higher than prewar consumption rate, particularly when new prime movers are developed

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WITH THE EXCEPTION of chromite, the supply of the ferro-alloying raw materials, discussed separately below, was more than adequate to meet industrial needs in 1946, the first full year of transition from a war to a peacetime economy. Demand is closely keyed to alloy-steel production, except for manganese, which more closely follows steel production as a whole. During the development of the alloy segments of the steel industry, its rate of increase has been greater than that for the industry as a whole. During the war, armament production greatly accelerated the rate of increase, so that it surpassed that for total steel output. With the peak of war requirements passed, an abrupt decline in the ratio of alloy to total steel production followed. However, in 1946 the ratio was still somewhat above that of the immediate prewar years.

Notwithstanding the severe setbacks as a result of strikes both in the coal and steel industries, steel production in 1946 bids fair to reach a peacetime record in the United States. During the first ten months of 1946, total steel production dropped 20% below that for the same period in 1945, while alloy-steel production decreased 35%. Alloy steel made up 9.1% of the total steel melt in 1946, compared with 11% in 1945 and a peak of 14.8% in 1943. Abrupt as this decline seems, it appears from present indications that the proportion of alloy steel melted may hold above the prewar level that ranged from 4 to 7% between 1920 and 1940. However, the probable postwar increase in this alloy-steel fraction will not necessarily be accompanied by an exactly parallel consumption of alloying metals, because of the persistence in use of a substantial quantity of N.E. and other low-alloy types of steels.

A relatively new field of alloy application is in the high strength-high temperature alloys necessary to withstand the conditions incident to the operation of gas turbines and jet-propulsion engines. A large number of the so-called "ferro-alloying metals" are essential components of these new alloys, and their consumption will increase as the new types of prime movers are developed and accepted.

During 1946 the Government again became a potential buyer of most of the ferro-alloying materials reviewed in this section when, under Public Law 663, signed by the President on Aug. 8, 1946, Congress provided an intial appropriation of $100,000,000 for the purchase of strategic and critical commodities. The Strategic and Critical Materials Division of the Procurement Division (Bureau of Federal Supply after Jan. 1, 1947) of the Treasury Department under the direction of the secretaries of War and Navy was authorized under Public Law 520 (signed July 23, 1946) to make purchases for the stockpiling program. The Army and Navy Munitions Board hopes to complete the program within five years at a total cost of $2,100,000,000.

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MANGANESE

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DOMESTIC MANGANESE-ORE production, unaided by the wartime Government purchasing program, suffered a sharp decline in 1946, and the number of active shippers dropped to a mere handful by the end of the year. Output, as measured by shipments from mines, amounted to 107,700 short tons for the first nine months of the year, and the 1946 total is estimated to be 153,000 tons, a decline of 16% from 1945. Arkansas, California, Montana, Nevada, New Mexico, Virginia, and Washington reported shipments during 1946. Shipments of ore containing (natural) 5 to 35% Mn amounted to approximately 985,000 short tons, of which 94% came from the Lake Superior district. In 1945 shipments of this grade totaled 1,522,854 tons. The Anaconda Copper Mining Co., after its contract with the Office of Metals Reserve was terminated on Sept. 30, 1945, temporarily stockpiled nodules at its reduction works but soon had obtained industrial contracts and was shipping at a progressively larger rate, until by the third quarter of 1946 shipments exceeded 40,000 tons. A considerable quantity of this ore went to the Pittsburgh, Pa., district via rail to Duluth, Minn., and Lake carrier to Lower Lake ports. A total of 67,883 short tons was shipped by this route during 1946.

Imports of manganese ore during the first nine months of 1946 exceeded consumption by 50% and were at a rate considerably in excess of that for 1945. However, consumption during the third quarter virtually absorbed imports, and in September receipts failed to meet industrial requirements. The Gold Coast shipped ore to the United States at a high rate throughout the first three quarters of 1946 and was the leading supplier of manganese ore for that period. Imports from Gold Coast totaled 262,919 short tons (January to September, inclusive), of which 38,364 tons was battery-grade ore. Receipts from India, which had been relatively low during 1945 as a result of a shortage of railroad cars in that country, again reached a large tonnage at the end of the first quarter of 1946, and India became the second largest supplier of United States manganese ore. Receipts totaled 218,602 tons in the first nine months, of which 2,229 tons were battery-grade. The U.S.S.R. continued to ship metallurgical and battery ore throughout 1946, and proposed that contracts be renewed into 1947. Russia shipped 166,862 tons of metallurgical ore and 36,919 tons of battery ore

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during the first three quarters. Other countries shipping manganese ore to the United States, and the quantities received during the first nine months, were: Brazil, 88,715 short tons; Chile 106,977 tons; Cuba, 111,462 tons; Union of South Africa, 190,688 tons; and other countries (Canada, Mexico, French Morocco, and French West Africa), 30,505 tons. In all, 1,213,649 tons were received, of which 78,184 tons were classified as battery ore.

Consumption of manganese ore totaled 810,161 short tons during the first nine months of 1946, compared with 1,174,256 tons during the same period of 1945. At the estimated fourth-quarter rate of use, approximately 1,150,000 tons will be consumed during 1946, compared with a 1945 total of 1,485,859 tons. Of the manganese ore consumed during the first three quarters of 1946, manganese metal and alloys utilized 92%, dry cells, 4%, chemicals 2%, and pig iron and steel, 2%. Consumption of ferromanganese and other alloys during 1946 is estimated at 490,000 tons and 173,000 tons respectively, of which 349,115 tons of ferromanganese and 123,120 tons of other manganese alloys were used during the first nine months of the year.

The production of ferromanganese is estimated at 500,000 tons during 1946, a drop of 19% from 1945.

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MOLYBDENUM

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THE ABRUPT DROP in production of molybdenum concentrates which marked the latter months of 1945 continued well into 1946 because of a sharp decline in consumption. In the first nine months of 1946 production of concentrates was 12 million pounds (in terms of molybdenum contained), and consumption was 11 million pounds. Compared with the same period in the preceding year, production and consumption were 48 and 40%, respectively.

The recession in consumption of molybdenum was greater than that in the production of alloy steel, which declined only 35% in the same period. The relatively greater decline in use of molybdenum is difficult to explain in view of the unresolved competition between the several alloying elements, as well as between the high-alloy and NE-type steels, and other indeterminate factors.

Production and consumption of both concentrates and products were at low points in the first quarter of 1946 but were of the same general order of magnitude as in the highest prewar years, 1937 and 1939. In the third quarter there was, however, a sharp upturn in the use of both concentrates and products.

Imports have never been consequential, and in the first nine months of 1946 (276,000 lb. molybdenum content) were about 42% of those for the entire year 1945.

The dominant position of one company in the United States as a producer of molybdenum has resulted in a remarkable adjustability of supply to demand. Stocks of producers and consumers increased only 4.3% in the first nine months of 1946 to a total of 17,622,300 lb. (molybdenum content). In the same period stocks of molybdenum products decreased 7.8% to 11,831,700 lb.

The quoted price of concentrates remained at 45c. a pound of molybdenum sulphide for material containing 90% MoS_2 minimum.

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NICKEL

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CONSUMPTION OF NICKEL in the United States, the largest consuming country, was at a much lower rate in 1946 than in 1945 and, as a consequence, output in Canada was substantially less than in 1945. However, production in Cuba, the second-largest source of supply for the United States, was at a slightly higher rate than in 1945. Domestic output of primary nickel was, as heretofore, small in 1946.

Monthly production of nickel in Canada ranged from 6,225 short tons to 9,240 tons, or about half of the available capacity, during the first nine months of 1946. Total output during this period was 68,996 tons, compared with 99,096 tons in the corresponding period of 1945. Because of greater demand, the operating rate was increased to about 75% of capacity during the last months of 1946. Exports of nickel from Canada during the first nine months of 1946 were 83,637 tons, indicating a substantial reduction in accumulated stocks.

Production of nickel oxide in Cuba during the first ten months of 1946 was 13,394 short tons averaging about 77% nickel, compared with 15,425 tons in the entire year 1945. Equipment repairs and other causes resulted in some loss of output during 1946.

Imports into the United States from Canada during the first ten months of 1946 (figures for full year 1945 are shown in parentheses) comprised 115,274,474 (150,392,339) lb. of metallic nickel, 33,719,728 (38,723,719) lb. of matte and washed sulphide, and 921,824 (4,965,965) lb. of oxide.

Receipts of nickel from Canada were supplemented by imports from Cuba and the United Kingdom in 1946. During the first ten months (figures for full year 1945 are shown in parentheses) Cuba supplied 27,289,919 (33,208,880) lb. of oxide and the United Kingdom 881,000 (6,411,878) lb. of metallic nickel. New Caledonia, which contributed 11,353,451 lb. of matte in 1945, made no shipments to the United States in 1946; its matte was exported to France in 1946.

Exports of nickel consist largely of products manufactured from imported raw materials. During the first ten months of 1946 (figures for full year 1945 are shown in parentheses) they comprised 9,195,131 (4,573,476) lb. of alloys; 1,404,943 (1,614,045) lb. of metallic nickel; 1,121,894 (267,145) lb. of nickel silver; and 658,205 (971,549) lb. of nickel-chrome electric resistance wire. Exports of sales and compounds were not separately classified by the U. S. Department of Commerce in 1946; 326,749 lb. were exported in 1945.

Effective Nov. 25, 1946, the International Nickel Co. raised its contract price for 99.9% electrolytic nickel from 31½c. to 35c. a pound, which includes the present duty of 2½c. a pound. The new price of 35c. advances it to the same level that has prevailed since Jan. 1, 1929, on spot sales. Comparable price increases were also made for the company's other nickel products.

Early in December announcement was made that the

contract with Freeport Sulphur Co. to operate the Nicaro plant in Cuba would terminate Jan. 31, 1947. The future of this operation remains in doubt.

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VANADIUM

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THE PRECIPITOUS 72% decline in the consumption of domestic vanadium ore in the first nine months of 1946, compared with the same period of 1945, records the most marked recession in use of the ores of any of the ferro-alloying elements. This recession is a result of the decline in alloy-steel production, as well as the transition from predominantly direct and indirect military applications to those of peacetime industry.

Production and consumption of domestic ore in the first nine months of 1946 were 751,000 and 912,600 lb. (vanadium contained) respectively, and there was a consequent decline in stocks of ore at mills.

Imports of ore and concentrates in the same period were 600,000 lb. (contained vanadium).

During 1946 the price of vanadium pentoxide in ore was quoted at 27½c. a pound, a published price that has remained unchanged since 1935.

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TUNGSTEN

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PRODUCTION, general imports, and consumption of tungsten concentrates continued their downward trend in 1946, declining for the third consecutive year, and were accompanied by some weakening in price.

Production of primary tungsten concentrates is expected to approximate 4,000 short tons (60% WO_3) in 1946, a 29% decline from 1945. A substantial part of the 1946 output, which was for the Government stockpile, was accounted for by the Government-owned Salt Lake City chemical plant. This plant discontinued operations in the third quarter, at the termination of the operating agreement with United States Vanadium Corporation. The flotation plant of Getchell Mine, Inc., Red House, Nev., which since August 1945 had been treating under toll agreement with the Office of Metals Reserve the stockpiles of ore in the vicinity of the mill, discontinued the milling of tungsten ore in April 1946. The concentrate produced was feed for the Salt Lake City chemical-treatment plant.

A chemical-treatment plant at Henderson, Nev., was completed and put into operation the latter part of 1946 by the United States Vanadium Corporation. At this plant concentrates containing 8 to 50% WO_3 from the company's Pine Creek and Riley mines, near Bishop, Calif., and Winnemucca, Nev., respectively, and custom concentrates from other properties, will be processed to a finished product either by acid treatment or pressure digestion treatment. The Pine Creek mine resumed production of ore in April; the ore is transported to the mine concentrator over a recently completed 2½-mile aerial tramway. The Pine Creek concentrator produces a medium-grade flotation product which becomes feed for the refinery at Henderson.

A mill to serve the Alpine mine, in Alpine County, Calif., was put into operation in May by the Alpine Mining Co. The milling plant near Rawhide, Mineral County, Nev., of Nevada Scheelite, Inc., was destroyed by fire on June 10, 1946, but will be rebuilt.

Receipts of foreign ore and concentrates also declined in 1946. They were 6,195 short tons (60% WO_3 basis) during the first ten months (9,078 tons during entire year 1945) and were received from 19 countries, but Bolivia (37%) and Brazil (19%) contributed 56% of the total. However, important quantities were also received from Southern Rhodesia and the United Kingdom. Unsettled conditions in China prevented that country from regaining its important position in the world market.

Imports of ore and concentrates for consumption in the United States were larger in 1946 than in 1945. They were 6,103 short tons (60% WO_3) during the first ten months of 1946 (5,016 tons during entire year 1945). These quantities represent ore and concentrates on which the duty has been paid and which have thereby entered into the commerce of the country. In addition, during the first ten months of 1946, 849 tons (60% WO_3) of ore and concentrates were withdrawn from warehouses for smelting, refining, and export (348 tons during entire year 1945), and 699 tons (gross weight) were re-exported (461 tons during entire year 1945).

Concentrates were consumed at a low rate during 1946 and during the first nine months totaled only 4,354 tons (60% WO_3 basis) compared with 14,900 tons during the entire year 1945.

Chinese ore was quoted at $24 a short-ton unit of WO_3, duty paid, and domestic scheelite of good known analysis, in carlots, delivered, at $24 to $24.50 a unit throughout 1946. However, prices on ores and concentrates from Bolivia, Brazil, and other countries were less steady and fluctuated between $24 and $21 a unit, duty paid. Ferrotungsten in carlots, delivered, was quoted at $1.90 a pound of tungsten throughout the year.

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CHROMITE

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DOMESTIC CHROMITE production declined from the all-time high of 160,120 short tons (of which about one-quarter was ore and the remainder concentrates) to 13,973 tons (all ore of 35% Cr_2O_3 content or over) in 1945, but preliminary figures indicate that 1946 production will hardly exceed one-tenth this latter quantity.

The average quarterly importation of the total of all grades of chromite in the first nine months of 1946 (196,500 tons) was 16% below the quarterly average in 1945, whereas the average combined quarterly consumption (179,500 tons) declined 11% and resulted

in an increased total of industry stocks of all grades of ore.

The situation in respect to metallurgical ore, however, stands in sharp contrast to that outlined above. Imports of this grade of ore have been substantially below requirements, resulting in large withdrawals from stockpiles. A major contributing factor has been the serious transport situation in Rhodesia, where the railroad is short of both rolling stock and manpower. Large stocks of metallurgical-grade ore are reported to be above ground at the mines awaiting shipment to tidewater. A second contributing factor is that 1946 shipments of metallurgical chromite from New Caledonia have been diverted almost entirely to France, whereas previously the United States was one of the major markets for this ore.

To meet this deficiency in supply, large withdrawals of metallurgical chromite from the stocks held by the Office of Metals Reserve were authorized by the Civilian Production Administration. In addition, some ore originating in the Union of South Africa, which is usually consumed in the manufacture of chemicals, has been substituted for metallurgical ore. Another factor that has accentuated the shortage of metallurgical-grade chromite is the sharp increase in the use of stainless steels so strongly in evidence in the last decade; the tonnage of stainless steel produced in 1945 was nearly five times that in 1936 and over twice that in 1940. The situation with regard to metallurgical chromite shows little prospect of improving unless additional supplies of this grade of ore become available.

Data for the first nine months of 1946 indicate that the consumption of metallurgical- and refractory-grade ores has been at a lower rate than in 1945 but that of chemical ore has increased slightly. Consumption of chromite of all grades in the first nine months of 1946 was 538,555 short tons, compared to 612,380 tons in the same months of 1945, a decrease of 12%.

The published price of African and Indian chromite, 48% Cr_2O_3, 3 to 1 chrome: iron ratio, held at $43.50 a long ton f.o.b. cars Atlantic seaboard throughout the year until early in October, when the price weakened to $40@$41.

* * * * *

LIGHT METALS

Demand for aluminum exceeds capacity of active facilities. Trend of magnesium consumption is firmly upward

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JAMES L. HEAD, Chile Exploration Co., New York

NINETEEN FORTY-SIX may well be remembered in the aluminum industry as a year when demand exceeded all expectations and a scramble ensued to obtain Government-owned facilities. Possible annual requirements of half a million tons of primary aluminum, as estimated in 1945, are already being exceeded. Consequently, unexpected shortages have developed in the light-metal field.

The immediate need of metal to refill commercial reservoirs and pipe lines, and the demand for light-metal products denied to civilians during the war, together with gradually increasing consumption in a host of new products, were readily foreseen. It was expected, however, that this increase would take place gradually. Instead, the industry found itself confronted with demands far in excess of the capacity of the private facilities, or of total facilities, had they all been in operation.

Acute shortages of a number of metals and nonmetallic materials caused an unforeseen demand for aluminum as a substitute material. It was wanted not only for the lowly cooking utensil, electrical and power-transmission fields, and for light-weight equipment in the automotive, aircraft, and railroad transportation industries, but for such items as roofing and siding, and wall panels for prefabricated houses. The demand for the metal snowballed. The expected flood of scrap, particularly from wrecked aircraft, over which there had been not a little apprehension, failed to materialize and such scrap as was available soon commanded premium prices. It was necessary to draw on Government-owned stocks of aluminum, and by the end of October these had dropped to 238,000,000 lb., a decrease of 36% since the beginning of the year.

In spite of these demands prices have remained at 14c. for aluminum pig (15c. for ingot) and 20.5c. for magnesium, the levels to which they were reduced during the war. The year-end thus finds the light metals in an increasingly favorable competitive position. Favorable also are the greater familiarity with light-metal characteristics, the development of new alloys, and confidence in the virtues of light metals and their alloys.

Disposition of the wartime alumina and aluminum reduction plants was already under way before the end of 1945. The insistent opponents of monopolism had decreed that none of these was to go to the Aluminum Company of America, which had designed, built, and operated them for the Government. Nevertheless, assurance had been given by Alcoa that it would grant licenses under its patents to its competitors operating Government-owned plants, a particularly important factor in the production of alumina. Lease by the Reynolds Metals Co. of the alumina plant at Hurricane Creek, Ark., and the nearby Jones Mill reduction works, had already been made known. Reynolds was definitely out to become a major factor in the industry, and before the year ended this company was able to announce the acquisition of such additional highly desirable facilities as the huge 288,000,000-lb. sheet mill at Chicago (McCook), Ill.; the extrusion plants at Grand Rapids, Mich., and Phoenix, Ariz.; and a rod and bar mill at Newark, Ohio. Reynolds is already interested in fabricating operations in Mexico and has hinted at further foreign expansion.

Much attention was centered on the Government's

aluminum facilities in the Pacific Northwest. During the war the establishment of a light-metal industry in that region had strong local backing. Reynolds already had a foothold with its reduction plant at Longview, Wash., and, with Alcoa out of the running, it became the successful bidder for the reduction plant at Troutdale, Ore.

Henry Kaiser, who had been operating two wartime magnesium plants, became the third entrant and a newcomer in the aluminum field by the leasing of the alumina plant at Baton Rouge, La., and the two plants at Spokane, Wash., known as the Mead reduction plant and the Trentwood rolling mill, the latter with an annual capacity of 288,000,000 lb. of plate, sheet, and strip. It has recently been announced that Kaiser also has purchased the small reduction unit at Tacoma, Wash., formerly operated by Olin Corporation. This is one of the few plants in the country employing the Soderberg continuous electrode instead of the familiar prebaked removable anode in general use. A prospective entrant into the field was the American Smelting & Refining Co. through its newly formed Asarco Aluminum Co., but it was an unsuccessful bidder for the Baton Rouge and Troutdale facilities.

Plants Left Have Big Potential

The accompanying table accounts for all of the wartime capacity of alumina from bauxite and about 67% of the primary pig aluminum capacity. The other 33% was distributed among the five remaining Government-owned plants—namely, Queens (Maspeth), N. Y., Burlington, N. J., St. Lawrence (Massena) N. Y., Los Angeles (Torrance), Calif., and Riverbank, Calif. The first two of these have been dismantled. Although the others have been advertised as available, it is unlikely that, with the possible exception of St. Lawrence, they will ever be utilized for aluminum production, because of various adverse factors. Nevertheless, the surviving plants could, at capacity operation, achieve a production that would be more than four times that of 1939.

Though the operating rates quoted in the foregoing were quite generally achieved during the war, they are potential ultimate capacities only. Few of the newly leased facilities were in operation before the second half of the year, and in most cases initial operations have been at a low rate. The producers have had their share of labor difficulties and material shortages, and these factors are still effective. Scarcity of the all-important soda ash is one example of an unforeseen shortage that will prevent capacity production of alumina in the immediate future.

Whether the potential rates can be reached and maintained depends largely upon the ability of the two smaller producers to operate at rated capacities. Their margins for excess production of alumina are adequate, but because of possible raw-material shortages it appears that there may be times when they will be dependent on their major competitors in this country and Canada for alumina. During the war the prevailing price of alumina suitable for reduction to metal was $50 per ton, freight excluded. In its offer to lease the Hurricane Creek works, Alcoa agreed to furnish alumina to others at from $34 to $40 per ton, depending on the rate of production at which they would be operating the alumina plant.

Mining of Arkansas bauxite is back to its 1941 rate of slightly under a million tons annually. This will increase to some extent coincident with increased output of alumina at Hurricane Creek. Alcoa and Reynolds are the most important producers. The only "independents" now operating are the mining affiliates of several abrasive and special-purpose alumina manufacturers. Long since departed are such wholesale dirt movers as the road contractors, air-field constructors, and levee builders who flocked into the Arkansas field in search of a spare forty acres or so from which to mine bauxite to sell to the Government, and who did a good and generally profitable job. The flourishing royalty business in unmined bauxite has collapsed completely. The industry again looks to the Guianas for most of its metal-grade bauxite, and imports of 456,000 long tons in the first seven months of 1946 represented the greatest activity since the end of the war. The wave of strikes extended to Surinam shortly after, and mining suspended for some weeks.

Adequate supplies and reserves of bauxite will present a real problem to the newcomers. The high-grade Arkansas reserves were greatly depleted during the war. The best of the remainder is largely owned by Alcoa, which, with an adequate supply of metal-grade bauxite available from its mines in Surinam, can devote its Arkansas material to the manufacture of special-purpose aluminas at its East St. Louis plant. Reynolds, having acquired with the Hurricane Creek works the only functioning "red-mud" treatment facilities in the country, can successfully treat lower-grade bauxite than the others. It is supplying its current demands from its Arkansas deposits and it may also obtain a certain portion of its requirements from the 2,785,000-ton Government ore stockpiles in Saline and Pulaski counties, Ark. Averaging about 50% Al_2O_3 and 12% silica, this stockpiled material is lower than the prewar specifications for metal-grade bauxite.

Kaiser, not being a miner of bauxite, is not at the

PRESENT DISTRIBUTION OF POTENTIAL CAPACITIES

		Annual Capacity in Pounds
ALUMINA		
Aluminum Company of America		
East St. Louis, Ill., and Mobile, Ala.		2,140,000,000
Reynolds Metals Co.		
Listerhill, Ala.	200,000,000	
Hurricane Creek, Ark.	1,556,000,000	
Total Reynolds		1,756,000,000
Permanente Metals Corporation (Kaiser)		
Baton Rouge, La.		1,000,000,000
Total		4,896,000,000
ALUMINUM		
Aluminum Company of America		
Alcoa, Tenn., Badin, N. C., Massena, N. Y., Niagara, N. Y. and Vancouver, Wash.		867,000,000
Reynolds Metals Co.		
Listerhill, Ala.	100,000,000	
Jones Mill, Ark.	(a) 144,000,000	
Troutdale, Ore.	144,000,000	
Longview, Wash.	65,000,000	
Total Reynolds		453,000,000
Permanente Metals Corporation (Kaiser)		
Mead (Spokane) Wash.	216,000,000	
Tacoma, Wash.	(b) 41,500,000	
Total Kaiser		257,500,000
Total		1,577,500,000

(a) Present available power sufficient for half capacity operation only.
(b) Will not be in production before early 1947.

present a completely integrated unit of the industry, and must depend on outside sources for its ore. It has purchased for shipment to Baton Rouge from Surinam a stockpile of about 100,000 tons of high-grade bauxite which was accumulated for the Government by the Billiton Co. Sinter or "red-mud" facilities were not completed at Baton Rouge, so the Arkansas stockpiles are currently of little use to Kaiser.

As a result of the unequal distribution of bauxite reserves, all producers have continued active exploration for new deposits, particularly in the islands of the Caribbean, the Guianas, and even as far away as the Celebes. Eventually a considerable tonnage may be imported from the Netherlands Indies.

Concentration of low-grade bauxite is still not an answer to the raw-material problem, although the U. S. Bureau of Mines reports that tests at its 50-ton experimental plant at Bauxite, Ark., has demonstrated that commercially acceptable concentrates can be made from off-grade material. Nor can "have-not" producers yet look to other raw materials to make up for their lack of bauxite. Confirming the opinions of the experienced and skeptical, none of the processes for producing alumina from other materials, upon which much hope, effort—and taxpayers' money—were expended, were brought to a state of economic production. Of the four experimental "alumina-from-clay" plants, Ancor, at Harleyville, S. C., and Kalunite, at Salt Lake City, discontinued operations months ago, and the latter plant has been declared surplus. Columbia Metals, at Salem, Ore., is turning out ammonium sulphate for fertilizer; the Monolith plant, at Laramie, Wyo., was not completed. It is reported that the Bureau will request funds to continue experiments at Harleyville and Salem. As a long-range project for a source of alumina for its Vancouver works, Alcoa is continuing its laterite exploration program in Washington and Columbia counties, Oregon.

North of the border a 60% cut in production below a wartime capacity of 1,100,000,000 lb., due to such factors as power shortages and scarcity of soda ash, has been reported. Nevertheless, the Aluminum Company of Canada has continued to export both alumina and aluminum. It is now storing metal for future export, and suggestions have been made that some of this should be "borrowed" from this company to relieve the current domestic shortages of ingot. Alcoa is also expanding its foil facilities and is adding an extension to the sheet mill at Kingston, Ont.

Foreign Situation Oscure

Space does not permit an attempt at a survey of the as yet imperfectly known foreign situation in aluminum. The industry in Europe was, of course, completely disrupted. It will be some time before restoration of it in Germany is possible or permitted. A complicating factor against early recovery is the fact that the prewar industry often traversed national boundaries. For instance, the Swiss reduction plants depended generally on France and North Italy for their alumina. Currently they must look to Canada and this country. Aluminum Company of Canada continues to expand its export business and, in addition, is an important factor in the production of aluminum in India, where its activities extend beyond the mining and reduction stages to fabrication. Increased production is reported from France, Sweden, and Norway. Extensive new deposits of bauxite have been found in the Urals, but so great is the demand for aluminum in Russia that substantial tonnages will have to be imported.

That the aluminum industry faces the future with great confidence is evinced by the new facilities under construction. Among these are Alcoa's new 120,000,000-lb. sheet mill at Davenport, Iowa, its new casting plant at Desplaines, Ill., and the doubling of its foil capacity. This company was also permitted to purchase the Government extrusion plant at Cressona, Pa., which has a capacity of 55,000,000 lb. and 14,000,000 lb. of sheet and tubes, respectively. Requirements for 1947 are estimated at 1,250,000,000 lb., of which one-third is expected to go into housing. This does not appear to be out of line, but such enthusiastic estimates as an annual consumption of six or more billion pounds by 1950 seem overoptimistic.

Magnesium Recovering Steadily

The magnesium industry, after the inevitable letdown from the gaudy opulence of its wartime career, is recovering steadily and is well on its way to a firm status among the important industrial metals. The pioneer, Dow Chemical Co., survives as the only producer of primary metal. The parent plant at Midland, Mich., has been shut down, and all of this company's magnesium production is concentrated in the now wholly owned plant at Freeport, Tex. Here the output will soon be at the rate of 40,000,000 lb. annually, some 11% in excess of its designed capacity. Although this production takes care of current needs, the consumption trend is definitely upward. Government stocks, which are down to some fifty or sixty million pounds, are frozen, but, as in the case of aluminum, would probably be released if acute shortages should develop.

Dow has recently purchased certain portions of the Dow-Velasco plant at Velasco, Tex., near its Freeport works. The metal-producing units, with a capacity considerably in excess of the rated 72,000,000 lb. annually, were not included in the sale, but are being maintained in standby condition by the Government. It is not unlikely, however, that arrangements can be made to put them into production when demand for the metal warrants. No other Government magnesium production plant has yet been sold or leased. Such interest as has been displayed has been for possible utilization for purposes other than magnesium reduction. Kaiser's Permanente Metals Corporation remains a potential producer. It reports a development to transform its carbothermic process from a batch to a continuous operation with a substantial reduction in cost. Previous operations at this plant never attained competitive status. In Canada, Dominion Magnesium plans to reopen its ferrosilicon process plant at Haley's Station, Ont., early in 1947. This plant, with a capacity in excess of 10,000,000 lb., was purchased from the Dominion Government in 1945.

More than fifty companies are now fabricators of magnesium. In addition to its use in the aviation and transportation fields, it is finding wide application in household goods, furniture, and sporting equipment. Development of an anodic treatment process has improved the resistance of the metal to corrosion and makes possible the production of magnesium articles in color. Many are now appearing on the market.

Estimates of future requirements vary widely and tend to be overly optimistic. Nevertheless, consumption is increasing. Within five years we may expect additional primary producers in the field, some of them probably wondering why they did not get in sooner.

A Survey of Mining Progress

A. H. HUBBELL, Managing Editor

Starting in this issue, operators here and abroad reveal substantial progress along many lines, also frequent ingenious innovations, with effort in general directed toward greater efficiency and lower costs. Continuing labor shortage and absenteeism throughout the industry have proved to be effective spurs.

CURRENT MINING PRACTICE is far from static. Outstanding developments, to cite at random some which are still more or less experimental, include fusion-piercing, recently announced; the application of shaped charges to breaking rock fragments and boulders, whether on the muck pile, or blocking a chute, or impeding advance in drilling; the increasing respect that diesel locomotives are winning in underground use; drifting with diamond drills; and tungsten-carbide-edged drill steel for ordinary rock drills.

Still other developments of present lively interest are: faster ways of shaft mucking; the widening use of transfer scraping to avoid chute loading; underground transport, both on rubber tires and by conveyor; blast-hole diamond drilling in stopes; the far-from-stagnant detachable bit situation; and big-hole boring. Moreover, in underground mines, study of stoping methods is constantly yielding new modifications, and in open pit work stripping procedure is about to undergo a change. Capacity of trucks used in pits, moreover, and the size of blast holes are on the increase, while excavating machines, having attained mammoth dimensions, appear to be ready to yield to the next size larger.

Labor shortage, plus absenteeism, and slow delivery of supplies have hampered mining companies and manufacturers in carrying out their programs. All mining operations have been impeded. The operators have been pushed toward a greater degree of mechanization. Automatic-feed drills, jumbos, and the more liberal use of mucking machines and scrapers have been looked upon as "life-savers." Despite this, one Utah superintendent, said recently that production, whether measured in tons or feet, has been lower than in many years.

The changing picture is sketched in the following pages:

Drilling's Many Aspects

The Percussion-Type Drill. The air-driven rock drill remains supreme in the field of breaking ore and rock underground. Aside from the use of electric-driven auger drills for breaking certain easily drilled non-metallic minerals, it has no competitor save the diamond drill and then largely for drilling stope blast holes under special conditions where the mining method favors the substitution of the latter machine.

Much work is being done to increase footage and tonnage per shift in rock-drill operation. Drilling cost can be cut by modernizing the drill. Too many old machines are "hanging on to life." The up-to-date power-feed, moderate-weight machine, with its low air consumption, high drilling speed, long life, and low maintenance, permits an immediate saving.

Air lines can be modernized also by using improved couplings that are easy to install and to salvage and that lose little air in leakage. These pay for themselves quickly.

Jumbos Cut Starting Time

Drifting efficiencies, and with them drifting costs, are also being improved by use of automatic-feed machines and by cutting the time required to set up. One company regards the auto feed as essential to the success of its shatter cut; another figures that with this type of feed it can drill 40 to 50 percent more ore per man. The power feed saves time and labor by speeding up the work of backing out of a hole.

Drill mountings have been improved. Time required for setting up and tearing down can be cut by use of jumbos, and by substituting air-column bars for jack bars in all headings.

To cite an excellent case, an Idaho company uses jumbos with pneumatic columns for drifts and crosscuts of ordinary and smaller size. The columns, with the crossbars and the machines, may be folded down to permit quick set-up and quick removal. Power-feed heavy-duty drifters are used, permitting quick completion of the round. Sturdy, fast mucking machines, cherry pickers, and ready locomotive service allow quick changes of cars. Thus the cycle can be completed without undue delay.

For drifts before the rails have been placed, this company has built a skid-jumbo, also equipped with air columns, which is handled by the scraper hoist.

Showing how time may be saved in setting up, four drifters on a jumbo were set up in six minutes in another mine, as compared with 20 minutes for setting up a single drill on a column in a development drift.

In the Eagle-Picher properties, in the Tri-State district, where caterpillar-mounted jumbos have been used for drilling in the open stopes since late in 1943, jumbo drilling has changed the arrangement of blast rounds as compared with the drill-hole pattern used with post-mounted drills, giving more tons per foot drilled and per drill-shift, and less powder per ton broken. About 30 jumbos have been in operation in the last 12 months.

Successful use of a 2-drill hydraulic "drill jib," made by Sullivan, in driving a minus-20½-deg. slope, is reported from Tennessee. Saving of time and labor was marked. Speed of sinking was almost doubled the first year.

Similarly, a jumbo is reported to have been used in drilling a 12-deg. incline in Colorado.

An Ontario company is working to improve the column to ease set-

ting up in headings and stopes.

Shatter cuts for drifting interest various operators and are being used increasingly. In one case, a 3-drill jumbo is used, and mucking is done with a loader. Advantages are: the round depth is limited only by time cycle, less power is required, the round pulls almost to bottom, and holes are easy to point.

French iron mines are reported to have been trying electric rotary drills for production.

Trend Away From Steel

Detachable Bits. Before the war 75 percent of the larger mines and quarries were estimated to be using detachable bits. The trend today continues to bits and away from sharpened steel. This is even more pronounced in Canada, where detachable bits are said to produce 90 percent of the mineral output. Comparative drilling costs usually determine the question of which to use, bits or steel. Labor shortage in the steel shop favors the use of bits. Where a labor shortage cuts output and shrinks profits, however, it may weigh against any change to bits. The variety of available types and sizes of bits tends to ease the task of finding a bit that is suited to special rock conditions.

Bits of two makes (Jackbit and Timken) continue to dominate the domestic field. In Canada two bits (Hayes and Craig) have the bulk of the business, the latter being of a single-use, or "one-pass," or throwaway type. In them is typified the contest between the two types. Scarcity of skilled labor for reconditioning favors the throwaway bit.

Single Use vs. Many Uses

As between the single-use, or "one-pass," or throwaway type of bit and the bit intended to give several uses by hot-milling or grinding, the cost that counts is the cost per bit-use, taking also into account the respective drilling abilities of the new bit and the reconditioned bit. A Canadian manufacturer has set up a reconditioning plant experimentally in an Ontario camp, where he sells his bit reconditioned at 7.6c., based on a production of 4,000 bits per day. There is always the possibility of reconditioning the throwaway bit.

In general, the number of usages obtained per bit varies widely with different mining companies. One is said to get as high as 14. Five to six may be taken as the average.

Some New Bits

Among the new bits are the following:

Of outstanding interest is the new stud-type bit attachment developed by Ingersoll-Rand. The short stud, made of the best possible alloy steel, is threaded on the bit end with an improved reverse buttress thread, and machined on the opposite end to give a cone having an undulating surface instead of a uniform taper. The stud is driven in the drill steel by means of a drill steel sharpener. A selection of newly designed Jackbits in a range of at least three stud sizes will be manufactured. The stud attachment permits heavier construction in small size bits, resulting in the blows of the drill being carried through the thick body of the bit.

Advantages are: (1) A mining company is able to purchase the finished alloy-steel stud with every thread made to factory accuracy; (2) use of the best possible steel in the stud permits a smaller cross-sectional area, together with design advantages in the bit; (3) the stud attachment permits the use of alloy drill steel in the fabrication of the rods.

A new 4-point, center-hole, threadless bit, which tightens in a quarter turn on two cams forged on the shank, developed by John Redington, at the Coniaurum mine (Ontario), has been in use at that property for four years past.

In the Tri-State district, Eagle-Picher has developed special three-wing bits for more efficient drilling in hard, abrasive ground.

Still under development and without commercial users, so far as known, is the Hokanson bit, patented (U. S.) in 1940 and assigned to Eidco, Inc. It is said to be designed for fast cutting with little gage loss, attaining a high rate of penetration by virtue of a small pilot followed by a reamer to enlarge the hole to wanted size.

American Mining Research Co., Philadelphia, is said to be developing a bit similar to the Hayes.

The Liddicoat bit, well known in Canada, has been adopted by Calumet & Hecla in Michigan.

What Size Drill Hole?

The proper size for a drill hole and for the bit that makes it is still a matter for discussion. By starting at 1⅜-in. diameter, for example, instead of at 2½ in., and using a $\frac{1}{16}$-in. gage change, as against a $\frac{1}{8}$-in. change with other bits, the smaller, shallower hole when completed to the desired depth will still be large enough to take sufficient powder, and can be drilled faster than the large one with the same machine. There are those who prefer this procedure, using a more concentrated blasting powder in the smaller hole.

The maker of the new stud-type bit mentioned above favors going to the smallest possible hole as the most economical, in that it permits labor saving through higher drilling speed and use of lighter weight rock drills with lessened air consumption and upkeep cost.

Canadian practice tends toward use of $\frac{7}{8}$-in. steel, though most operators are still using 1-in. quarter-octagon. Of 52 mines in Ontario and Quebec, 32 employ 1-in. quarter-octagon, and 20 use $\frac{7}{8}$-in. steel. Most of the former are using straight carbon steel. All of the latter use some alloy steel. Others prefer to drill the larger hole with the larger bit and to use heavier charges of less concentrated powder.

Detachable bits have recently been extensively developed on the Rand, in South Africa, many variations of the original design being evolved. The two principal types are the Padley & Morgan (commonly called the "P & M.") and the Bedford "Simplon" (*E.&M.J., July* 1946). Both are threadless and utilize a taper fit, the Bedford having a

IN ACKNOWLEDGMENT

Operating details and data presented here have been obtained for the most part directly from the industry; largely through recent correspondence, although information acquired by actual observation in the field by the author and other members of E.&M.J.'s staff is also included.

Thanks are due the many mining company executives and engineers, faculty members of various mining schools, and correspondents who have contributed; they are also due the manufacturers who have so freely told of trends and developments in the equipment field.

copper sleeve. The Bedford is also a reforgeable bit, whereas the P.&M. has been sold as a throwaway.

Rapid adoption of these bits on the Rand has, however, been checked by the recent introduction in *experimental* quantities of chisel-edge bits, or jumpers, containing tungsten-carbide (hard metal) inserts. These are made in Sweden.

Hard-metal bits for use in percussion-type rock drills have been under development in the United States also for some time. This development, delayed by the war, is reported to be having excellent results, a superior product in respect to drilling performance being almost ready for announcement.

The "Hard-Metal" Bit

Three companies, A. B. SKF Hofors Bruk, at Hofors; Sandvikens Jernverks A.B., at Sandviken; and Fagersta Bruk A.B., at Fagersta, all in Sweden, are understood to be making the bits being tried on the Rand. According to a South African correspondent, three mines, each in a different group, are making extensive experiments, one of them using 150 of these jumpers in a large-scale test. The bit thus far used on the Rand has been chiefly a chisel bit with two water flushing holes at the side. The tungsten-carbide insert forms the cutting edge and is brazed into a slot prepared for it at the end of the jumper. A triangular bit with three separate inserts of tungsten carbide and side flushing holes has not proved generally successful. Cross bits with a central flushing hole and four separate inserts are reported also to be in use, though the results are not known as yet.

For one of the three makes, the chisel bit, when fashioned on ⅞-in. steel, has a gage range of 1.14 in. to 1.32 in. with a gage differential of 0.039 in. Experimental drills have penetrated considerable distances without serious loss of gage.

Drilling speed obtained is the same as with an ordinary forged bit of the same diameter; however, the hard-metal bit is said to retain its gage, and so, in drilling a 36- to 42-in. hole, it shows an increase in speed from 8 in. to 12 in. per minute, with a number of advantages in cost per foot drilled.

No special technique is said to be needed to use the tungsten-carbide bit. Care must be taken not to force it if it tends to jam. The machine must be kept in line with the hole. When collaring, the machine must be kept at right angles to the face.

Experiments have indicated that a jackhammer drill is best, this on the Rand where 95 percent of holes in the Reef are 3 ft. 6 in. long and drilled by native boys with jackhammers and 4 ft. 6 in. steel. A standard machine with reduced stroke and increased number of blows per minute is being tried.

"Hard Metal" Can Fracture

As to fracturing of tungsten carbide in service, this does happen. Different mixtures of the carbide with titanium, cobalt, and chromium are being tried out, however, to obtain a compromise between brittleness and hardness.

Experiments with the tungsten-carbide bit in development headings are only now (early December) being started. The long jumpers whip in the hole, and it is thought that two of different gage will be needed to drill a round.

The tungsten-carbide bits are reconditioned on a greenstone wheel when a bit has drilled 60 ft. of hole, at one mine, water or a jet of compressed air being used for cooling. The latter is important because of the difference in the coefficient of expansion of steel and tungsten carbide. Bits, when old, are discarded at present.

Drills Sold at £3 10s.

Jumpers are reported from South Africa to be sold at £3 10s. each. A life of 100 ft. is obtained in average hard rock and about 200 ft. in softer rock. This gives a cost of 8.4d. and 4.2d. per foot respectively, as against 5.5d. per foot with a Padley & Morgan bit. Thus the cost lies in a range which is roughly the same as for detachable bits. Some reduction should be possible with increased production.

The companies in Sweden have been supplying the complete jumper. Local Rand opinion holds that the bit would be cheaper and just as efficient if only the insert were imported and it were brazed into a stem of locally made steel.

An "attachable" bit having a tapered connection with the stem is said to be on order.

Small fish-tail bits, of Krupp make, with tungsten-carbide blades brazed on the main body, are said to have been brought back to the United States for study from Germany, where they are reported to have been very effective in long-blast-hole drilling in potash mines.

Rod Steel Improved

Drill Steel Composition. Most hollow drill steel used in this country for making sharpened steel and for detachable bits is a special carbon steel running approximately 0.75% carbon; 0.25 manganese; 0.021 phosphorus; 0.02 sulphur; and 0.20 silica. In a few places, the same analysis, save that the carbon is 0.60 to 0.65, is desired in a steel for use with detachable bits. In Canada the demand for alloy hollow steel is good. Bethlehem and Crucible, in this country, with Ingersoll-Rand, have recently introduced an alloy grade, for use with detachable bits, that runs 0.28% carbon, 0.95 manganese, 0.28 silica, 2.25 nickel, 0.65 chromium and 0.30 molybdenum. Its performance will be watched with interest. Other manufacturers are said to be producing similar grades. Use of this type of hollow-drill steel is expected to increase, particularly for special bits and where rod breakage has been severe.

Other interesting recent developments in drilling in the manufacturing end include the introduction by Worthington of a complete new line of rock drills, known as the "Blue Brute," and the adoption by Joy's Sullivan Division of cadmium plating for its line of rock drills which fittingly are known as the "Silver Streak." Outstanding advantages claimed for cadmium plating are corrosion protection, especially for parts kept in stock; better lubrication and prevention of scoring in a new drill; and longer life, consequent on the foregoing.

Diamond Prices Rise

Blast-Hole Diamond Drilling. At many, if not most, mines today the diamond drill, especially the lighter models, has come to be regarded as regular equipment. Going beyond their use of it for stoping, a few companies have recently been trying to do drifting and slashing with it also, as well as "raising."

The rise in selling prices of industrial diamonds during 1946 (75% on regular grade on June 10 and 50% on select drilling bortz on Sept. 5) probably deterred some companies from proceeding with plans to use diamond drills for stoping. The record shows that some users actually curtailed such work, in part because the war was over, in part for other reasons including the high price of stones. Cost per foot of hole, by one estimate, rose 100 to 300%, seemingly prohibitive.

CURRENT BLAST HOLE DIAMOND DRILLING DATA, NOVEMBER, 1946

Company	% of Total Tonnage	Size of Hole	Ft. Per Machine-Shift, Average	Tons Broken Per Ft. of Hole	$ Cost Per Ft.	Result of Increase in Price of Diamonds
Large unnamed	20	EXT, 1 1/2 in.	60	2.5–3.5	0.444	Anticipate 20% increase in total drilling costs, necessitating in some cases mining by shrinkage methods with Leyner drills.
Alan Wood Steel Co.	10	EX, 1 1/2 in.	31.6	5.36	0.95	Bit price up 25%. Increased cost per foot of hole, 6.8c. Increased cost per ton broken, 1.27c.
Britannia Beach	40 (of tons drawn)	EX, 1 1/2 in.	37.6	5.17	0.85	Has increased cost per foot of hole by approximately 25%.
Canadian Malartic	80	EX, 1 1/2 in.	36	2.2	1.00	Forced conversion to rock-drill methods in new stopes and wherever development is adaptable in old stopes.
Canadian Refractories	90	EXP, 1 3/16 in. EXT, 1 1/2 in.	75–150 30–70	3± 4±	0.27 0.41	Has increased cost per foot of hole, but this is so small as to make little difference in comparisons between diamond-drill stoping and former practice.
Cananea	60	EX, 1 1/2 in.	60	3.5	0.44	OPA prices apparently forced bit makers to make inferior bits. Work has been materially affected.
Climax Molybdenum	..	1 7/16 in.	....	....	....	This work was experimental. Results thus far have been adverse.
Cons. M. & S. Co.	61	1 15/64 in. 3/16 in. reaming shell	86.8	3.5	0.406	Diamond loss per foot drilled has risen from $0.046 to $0.067.
Dome Mines	8 (Sill pillars and ore in old sections)	1 7/32 in.	47.4	0.6–1.6	....	Drilling contracted on cost-plus basis.
East O'okiep Mine	55	EX, 1 9/16 in.	40.0	5.0	5s. ($1 U.S.)	Higher price and poorer quality increased diamond cost per foot.
East Malartic	21	EX, 1 1/2 in.	40	3.13	0.90	Increase of contractor's price from 80 to 90c. per ft. has not effected company's decision as yet to use diamond drill in those places where it is best machine for purpose.
Golden Manitou	10	1 1/2 in.	40–60	....	0.65	Has increased contractor's price per foot 25%.
Granby	100 (exc. development ore)	1 1/4 in.	40.89	4.05	0.52 to 0.553 incl. blasting	None. Drill operators more experienced than when cost of diamonds was lower.
Hanna Co.— New York	65	EX, 1 1/2 in.	No data yet	....	....	Costs more.
Howe Sound — Wash.		1 3/16 in. 1 15/16 in.	40 26–33	4 8 plus	....	
Johnson's Company	All open-pit bench Undercutting only	2 in. 1 1/4 in.	50 70	6.5	0.30 0.40	Slight. Slight.
Matachewan	(Pillar recovery)	1 1/2 in.	27.7	3.5	1.12	No change in methods.
MicMac	73	1 7/32 in. bits	75	2.0±	....	Increased costs.
National Gypsum	80	EX and LM bits	150	5.02	....	None.
Noranda	Most	1 3/16 in.	66.9	3.67	0.35*	None.
Pamour Porcupine	90	1 13/16 in. with reaming shell	80.0	3.00	....	Has added 30% to drilling costs.
Iron mining company	5	1 13/32 in.	33.5	4.35	0.46 (Bits)	Limited use makes this unimportant.
Sladen Malartic	99	EXK, 1 7/16 in.	49.0	1.50	0.95	None.
Tennessee Copper	75	EX, 1 1/2 in.	87.0	2.75	0.60**	Increased planning to save footage per ton and to prevent destruction of bits. Use of conventional bits and machines in hard rock when possible.
U.S. Vanadium, Bishop, Calif.	50	EX, 1 3/16 in.	47.0	4.33	1.00	Contractor asked for higher price, claiming deficit.
Waite Amulet	95	1 1/4 in.	80–100	4.00	....	Recent increase in diamond price has made very slight increase in over-all cost of drilling.
Warner (Gypsum)	50	EX, 1 15/32 in.	125	5.0	0.17*** 0.32	Increased drilling cost 1.5c./ft.

* Noranda cost per foot of hole includes supervision, machine repairs, carbon costs, warehouse supplies, runners and helpers.

** The 60c. cost per foot of hole includes the following items: Bits, 25c.; drill rods, 4c.; reamers and core barrels, 1c.; machine repairs, 5c.; labor, including labor for blasting, 25c.

*** 0.17 is for labor and bits. Total of 0.32 includes explosives but not power or maintenance.

What counts, however, is the cost per ton broken. This can be negligible, where tonnage broken is big, as shown at two Pennsylvania nonmetallic mines which average 2,000 ft. of hole per bit and get 10 to 12 tons broken per foot.

The over-all picture seems little changed. A tally shows 40-odd companies stoping with diamond drills, approximately the same as when *E.&M.J.'s* summary was published in October 1945. At the same time that some companies have started the practice, others have stopped it, which is not necessarily significant, inasmuch as with some companies the use of diamond drills for stoping may be only intermittent.

Among the newcomers are the O'okiep Copper Co., in Southwest Africa, and the two gypsum companies (National and Warner), in Pennsylvania. It is believed, though not verified, that blast-hole diamond drilling is being used to some extent in the copper area of Northern Rhodesia and by at least one well-known company in Australia. In fact, the advantages of the practice and the reasons for its use are such that no one need be surprised if any company at any time and place suddenly enters the picture as a user, or retires from it.

In the table on page 95, data are given on the blast-hole diamond-drilling practice of certain companies which have answered the request for information. Somewhat more than half of the users are represented. The effect of the increase in the price of diamonds, it will be noted, is much the same. As said before, one must look beyond the increase in cost per foot to the effect on the cost per ton broken.

Toward a Bigger Hole?

C. H. Hopper, of Boyles Brothers, says that experiments in blast-hole diamond drilling made with AX size (1⅝-in.) hole have been encouraging, this size giving a powder concentration of 1.6 lb. per foot of hole and breaking 8 or more tons per foot under good conditions. In quarry work, moreover, he states they are using an inclined (70-deg.) face successfully and are breaking up to 10 tons per foot of A-size hole.

Howe Sound, at Holden, Wash., has increased the size of its diamond-drill blast holes from 1⅞ to 1⅛ in. in diameter in the hope that fragmentation can be improved at no increase in cost and possibly at a saving. The cross-sectional area of the larger hole is 2.95 sq.in., as compared with 1.11 sq.in. for the smaller. Powder consumption per ton is almost unchanged, being calculated at 0.148 lb. for the larger hole, as against the one-year average of 0.12 lb. for the smaller. More than 8 tons is broken per foot of 1⅛-in. hole, compared with 4 tons per foot for the 1⅜-in. hole. The larger hole is drilled at 26 to 33 ft. per machine-shift and the smaller at a rate of 40 ft. Tons broken per machine-shift is 208 to 264 for the larger hole and 160 for the smaller, an increase of 30 to 65%.

Johnson's Company, in Quebec, now does its undercutting with diamond drills in place of rock drills, which formerly did the ring drilling. It uses an XRT-1⅞-in. noncoring pilot bit of its own design, save in granite, where it substitutes a coring bit. A 5-ft. burden and 3-ft. spacing are employed. It drills 70 ft. per machine-shift at 40c. per foot. Powder is 75% Forcite.

This company in its open pit drills a 2-in. hole with an AXT 1⅜-in. non-coring pilot bit of its own design. It drills 50 ft. per shift at 30c. per foot and breaks 6½ tons per foot. The burden is 19 ft. and the spacing 4 ft. Forty-percent Forcite is used, in 1¾x16-in. sticks.

Shrinkage Stoping Used

Warner Co., Bellefonte, Pa. (listed), which started diamond drilling only last August, is using shrinkage stoping and drilling 140-ft. horizontal parallel holes from a slot at each end of a stope 300 ft. long. There are eight holes in the 50-ft. width and the burden on the round is 10 ft.

Canadian Refractories, Ltd., Kilmar, Que., has made a change in stoping method in conjunction with its diamond drilling. Two stopes are now in production using horizontal blast holes drilled from end raises, with 6- to 10-ft. burden, depending on rock conditions, with light drilling in the center to allow for the natural tendency of the belly to cave. One stope, 40x200 ft., is breaking over the draw system to a slusher drift. The other stope breaks over a mucking-machine draw system, with blast holes drilled from two inclined raises on the walls of the orebody to a shrinkage slot at end. The orebody is 90 ft. wide. A block is 125 ft. long.

Diamond drills used for blast-hole work continued to be largely operated by compressed air. So far as known, electrically operated machines are still limited to the specially built Sullivan drills employed in the hard ground of the Soudan iron mine, in Minnesota, and to the models developed by E. J. Longyear Co. and Boyles Brothers.

In view of what has already been said about the experimental use of hard-metal bits with air-driven rock drills, it may be added that certain opinion here holds that should a definite trend develop in this direction, it would result in use of smaller gages, longer holes, longer feeds and lighter drills, this in turn presenting the definite possibility of the hammer drill pushing the diamond drill out of the picture for blast-hole work.

Carbide for Rotary Bits

"Hard-Metal" Rotary Bits. Use of tungsten carbide in percussion jumper drills made in Sweden has already been discussed. The carbide is also used in rotary bits.

"Hard metal" (cemented carbides, tungsten carbide) has been known for twenty years. It was used in Germany, after World War I, in dies for wire drawing, and was marketed in 1927 at the Leipzig Fair under the trade name "Widia" (*wie diamant*). Ten to fifteen years ago experiments were started, also in Germany, in drilling rock with hard-metal bits. Since 1942 the Sandvik Steel Works have carried out extensive experimental work successfully in the company's iron mine at Bodas, in Sweden, so that their "Coromant" drills are now in regular use. Coromant is said to contain about 20% of tungsten carbide and 10% of cobalt. It is a sintered product and is not forged or hardened. Rock-drilling speed with bits made of it is about double that obtained with ordinary sharpened steel. To date it has not been demonstrated that it is generally applicable to mining.

Today a fair number of tungsten-carbide bits are in use in diamond drilling in the United States and, in some instances, are said to have given very satisfactory results. Both the Longyear and the Sullivan (now Joy Mfg. Co.) companies handle bits faced with hard metal, some of it tungsten carbide. A correspondent writes:

"Only recently I saw two bits made with tungsten-carbide inserts; that is to say, small slugs of tungsten carbide set in a diamond-drill bit blank. In very soft formation, such as the Pennsylvania shales, they do an excellent job, but

duration is disappointing. I have also seen a diamond-drill bit set with small tungsten-carbide inserts in place of diamonds, but these did not prove satisfactory. There is no doubt in my mind that substitution of certain abrasives for diamonds will take place over the next few years."

Bits having tungsten-carbide inserts used in a Western mine are reported to have given excellent performance. With one it is possible to drill 16 ft. where previously 160 ordinary detachable bits had been required. At another property in the West, a bit hard-faced with Stoody Company's borium on the cutting edge and also on the reaming edge, so it will not lose gage, has given 50 ft. of hole, as compared with 8 ft. obtained with the conventional detachable bit.

Drill Fittings Standard Up

Late in 1946, revision of Diamond Core Drill Fittings Commercial Standard CS 17-42 was submitted by the National Bureau of Standards to the trade for acceptance upon recommendation of the Diamond Core Drill Manufacturers' Association. The recommended revision presents the requirements of the 1932 edition to replace the 1942 edition which, due to the war, was not put into effect. Under it the four sizes of diamond core-drill casing will be known as EX, AX, BX, and NX; likewise the corresponding sizes of bits, core barrels, and casing couplings. Rod and rod-coupling sizes are known as E, A, B, N.

The appropriate sizes of standard cores are: EX, $\frac{7}{8}$ in.; AX, $1\frac{1}{8}$ in.; BX, $1\frac{5}{8}$ in.; and NX, $2\frac{1}{8}$ in.

Outside diameter of casing is: EX, $1\frac{13}{16}$ in.; AX, $2\frac{1}{4}$ in.; BX, $2\frac{7}{8}$ in.; and NX, $3\frac{1}{2}$ in.

Drifting Experimentally With Diamond Drills

A large company which has been studying the factors entering into drilling so as to improve its drifting efficiencies has tried one large center hole (up to $6\frac{3}{4}$ in. size) in place of a shatter cut, at the same time using long drift rounds up to 16 ft., this with diamond drills save in soft and medium ground, where the rock drill has been used for all save the center hole. The best combination of cut-hole diameter and length of round is sought.

Waite Amulet, in Ontario, has been using diamond drills in slashing out drifts to standard widths and in undercutting over drawholes.

National Tunnel & Mines Co., in Utah, drove what is called an upside-down raise by diamond drilling from a level into a stope below. Sections were loaded one at a time and blasted down into the stope.

Blasting Sensation

Explosives. So far as we know, the war's sole direct contribution to mining practice thus far has been the shaped charge, a development of 1946. Learning of the so-called Monroe effect, through an article by V. Torrey in the *Explosives Engineer* for July 1945, and having available a returned veteran who had had much experience with the use of shaped charges in demolition work in the Pacific theatre, a Utah company, National Tunnel & Mines Co., set about experimenting with explosives in homemade containers designed to produce and utilize the jet effect that had worked such wonders in destroying tanks. The results of this test work, applied in secondary blasting and in opening plugged raises, have been described in an article by J. B. Huttl, *E.&M.J.*'s San Francisco editor, and subsequently by W. T. Warren, mine superintendent of the company named, in a paper presented at the Denver meeting of the Mining Congress last September.

Meanwhile, R. S. Lewis, professor of mining at the University of Utah, with G. B. Clark, graduate student, were investigating the subject and published their detailed observations last fall in one of the University's bulletins.

An additional paper dealing with the use of the shaped charge for breaking boulders encountered in drilling placer ground, by J. L. Roos, is in the January *E.&M.J.*

Latest word has it that an Arizona copper company is also experimenting with the shaped charge. It is also reported to be under test in Sweden. Thus a large mass of facts is being accumulated and much depends upon interpretation.

Explosives in which part of the nitroglycerine has been replaced with cheaper materials, such as ammonium nitrate, to give them inherent strength at less cost, are being increasingly used, not only because of their economy but because of the acute shortage of glycerin. Of high strength, which is divided up into more cartridges giving proper strength per stick at lower cost, they introduce the greatest economy into blasting. They also improve safety.

A safer method of packing detonators has been developed.

Fewer than half of the explosives employed in industry are detonated electrically. Nevertheless, the trend in recent years has been toward use of electrical methods because of their greater efficiency and safety, according to the U. S. Bureau of Mines, which advocates electric blasting on several counts.

A potash mining company in the Southwest reports the use of perforated sticks and fast delay caps. The latter, it says, give better fragmentation and reduce the quantity of explosives.

According to a maker, results indicate that these "short period" delays, properly used, reduce the vibration from the shot and improve the backbreak. They permit various advantageous combinations with instantaneous delays.

Mechanization of Mucking Has Reached High Degree

Scrapers and Loaders. Never has mucking been so highly mechanized as today. In all but the smallest mines hand-shoveling is disappearing rapidly. Manpower shortage has promoted the wider and more efficient used of scraping and of mechanical loaders.

An officer of a company in Utah says, "It is our policy to increase the mechanization of our underground operations wherever possible. Emphasis has been placed on a slushing system, using tuggers and scrapers." A Washington operator is experimenting to increase the tonnage obtained per scraper-shift. In another mine, in Colorado, larger slushers have been provided to permit use of maximum-size scrapers (limited to timber clearance). An Ontario company, to improve efficiency of operation, has added as much mechanical equipment as can be handled, such as loaders and slusher hoists—all standard machines in standard set-ups.

A scraper 72 in. wide that folds up when pulled back, thus avoiding a heavy pull on the tail sheave when large rocks are encountered, is in use by Climax Molybdenum Co. It is 56 in. high open and 26 in. folded. The pull rope is not attached to the bail but slips through a sleeve and is attached to an extension on the folding part of the scraper lip. Other advantages are: damage to

scraper on the return trip is averted and power costs are somewhat lower. Also, when the rope is buried, the scraper tends to dig itself out of the muck pile when pulled back and forth. It is estimated that a saving of 3c. per ton in loading costs is made.

Two other companies, one in Canada and one in Washington, are likewise reported to be employing a folding type of scraper.

Transfer scraping as a substitute for loading cars at chutes that receive their ore via grizzlies and bulldozing chambers above, is finding wider adoption because of its economy, efficiency, and reduction of chute accidents. A British Columbia company finds that secondary blasting can be done safely and efficiently at drawpoints from a slusher drift, this conforming to the experience of other operators.

Use of rails as a scraping floor has been abandoned by an Arizona copper company, in favor of a plank floor or, better, no floor at all. Scraper men are trained to keep a loose muck bottom for the entire length of the drift. The method avoids excessive wear on the scraper blade where it rides the rails. It also does away with difficulties when swelling bottom heaves the rails up out of line. Another company lays the rails at a slight angle to the center line of the drift, so that the blade does not wear at the same points.

The Scraper Is Versatile

One mine uses a small tugger hoist at slusher drifts to pull new scraper ropes through the tail sheave. This has made it possible to pull ropes as large as 1¼ in., and much faster and more safely.

In general, the scraper is versatile. A 7½-hp. air hoist with a 36-in. hoe-type scraper serves a certain company for leveling off stope fill and for other light work. Contrasting in size are the scraper hoists at Flin Flon, which range up to 150 hp. A Quebec mine uses air-driven scrapers to muck out shaft crosscuts on new levels to the waste pass. In the Tri-State district, both track-mounted and caterpillar-mounted three-drum slushers are in service.

Mechanization of mucking is making headway abroad. Workers in the iron mines of France now number 20,000, compared with 29,000 in January 1939. They are said to produce only 75% of their prewar output, because of poor nourishment, despite good morale. Approximately 60% of French iron ore is now reported to be mucked by scrapers and mechanical loaders.

With this introduction of mechanical loaders it is anticipated that better drills, bigger locomotives, larger cars and wider tracks will also appear, together with skip hoisting, all to match the greatly increased pace of loading.

The Loading Machine

Mechanical shovels, or loaders, have come into their own. For years limited to development work, save in special cases where they were used for loading ore (as in Southeast Missouri), they are increasingly finding other applications. In a Michigan copper mine five shovels are used in cutting out and in cleaning behind stulls, as well as in drifting. A Tri-State operator holds that the Eimco type of machine, cat-mounted, gives promise of being used extensively wherever conditions are favorable.

Shovels competing with the scraper-slide in mucking out development headings appear to be gaining ground in this quarter. They are considered standard equipment for the big Canadian nickel company in all headings save 4x6-ft. exploration drifts. Here two sizes of buckets are used—9 cu.ft. and 5½ cu.ft.

As with other equipment, problems arising in working with loaders have been solved in ingenious ways. For example, both at the Climax mine and in the Tri-State district a small water spray is used on the loader which is directed against the muck pile to keep dust down while loading.

At the Homestake mine, for replacing a derailed loader on the tracks a special bar is mounted above the loader across the drift. With it, using its own power, the loader can get back on the rails.

A third instance is the use of a portable turntable at a Western mine to turn the loader around easily when employed on a two-heading job. The turntable fits over the track.

An Ontario company seeks to design a mine car that is better adapted for use behind a mucking machine than those currently in use, which are well suited for hand mucking or chute pulling.

Mechanical mucking has been extended to shaft sinking in two outstanding applications. In one of these, an Eimco-Finlay machine was used on a 23-deg. 5x7-ft. incline in the Apex Standard mine of Chief Consolidated Mining Co., the shovel being held in place by cables fastened at one end to spikes in the ground behind the machine and at the other end to drums attached to the front wheels. The machine's center of gravity is thrown back far enough by passing these cables over idle pulleys on the rear axles and driving a bar under the track and over the cables 6 ft. back of the shovel. A considerable saving in cost is claimed.

Likewise in mucking out a 12-deg. incline in a Colorado property a shovel is being used.

For vertical shafts the Riddell shaft mucker is finding favor. Patented by J. Murray Riddell in 1942, it consists of a ¾-cu.yd. clamshell bucket hung from a carriage that carries three air-driven motors and is movable within a frame attached to the shaft timbers. With it, a shaft of an Idaho company was deepened 1,500 ft. in 1946. The mucker is also being employed at the present time in the shaft of a Nevada mine.

A winze round has been mucked with a scraper in a Colorado mine at an inclination of approximately 20 deg. The scraper first mucks out the face to a nearby point to permit setting up for drilling, and then mucks the pile to the head of the winze, where it is shoveled by an Eimco loader.

Clean Cars Hold More

A 20% increase in daily tonnage hauled to shaft has been effected at some mines on the Rand by washing out each car after every trip. The 1-ton cars are run singly into an iron frame, which is lifted by air or hydraulic cylinder and rotated 105 deg. so that car may be washed by high-pressure jets. Water is taken from a special pump or from a pump column. Washings are caught in a separate car, which is dumped into a settling sump, the excess water overflowing to the main sump. The mines referred to handle up to 7,000 tons per day each, all in 1-ton cars. The clean empties require less effort in switching, so that over-all personnel is not increased, according to the management.

Underground haulage and transport (particularly diesel haulage), and other underground operations, will be discussed in Part II of this article in the March issue of E. & M. J.

Economy, Simplicity Now Watchwords in Milling

R. H. RAMSEY, Associate Editor

Pre-concentration steps to aid treatment of tailing piles, automatic controls and simplified flowsheets to cut operating costs, success with oxidized and non-sulphide minerals—these mark the year in milling.

NOTHING could be more symbolic of the state of ore dressing in 1946 than the fact that ore dressers began to straighten their backs from the long silent labors of the war years and to express loudly and publicly their dissatisfaction with traditional attitudes. The wartime emphasis on production alone was lifted, and new techniques and new ideas began to be tried everywhere. Mineral dressing was again becoming free to re-equip, to experiment, to expand and progress, and though advances can be reported for 1946, the year ahead looks even better.

Trends

The Student. Three years ago in a discussion of mining, milling, and smelting costs, it was stated in *E.&M.J.* (Jan. 1944, p. 75) that "No college graduate in ore dressing from now on should consider himself educated unless he has a good acquaintance with the unit processes and the theories of chemical engineering along with his thorough knowledge of the technique of his own branch of engineering."

This point needs no belaboring, because a simple survey of the field, such as this very discussion, demonstrates the continued growth of this trend. If the foregoing quote were to be amended at all, it would be to add mechanical and electrical engineering to the list of adjuncts to the mineral dresser's equipment. This, of course, creates a problem in how to pack about six years' education into four, and ore dressing teachers everywhere, and an A.I.M.E. committee, are now wrestling with such curricula problems.

Cost-Cutting. Not only are processes new to milling being applied in the field, but new and less expensive ways are sought of running the old processes. The combination of high wages and other costs with decreasing grades of ore renders some form of cost-cutting essential, and in milling this past year certain general indications are apparent of the form this effort is taking.

There is the over-all method of designing a mill for labor economy. (Subject of A.I.M.E. T.P.1997 by Norman Weiss.) The whole aim is to get along with fewer men to increase the production per man-shift. For example, large crushers have been installed at Standard Cyaniding Co., the Getchell mine, Bunker Hill, Idaho Maryland, the Donovan mill at Silver City, Nev., and others, the idea being to crush the day's grist in one shift.

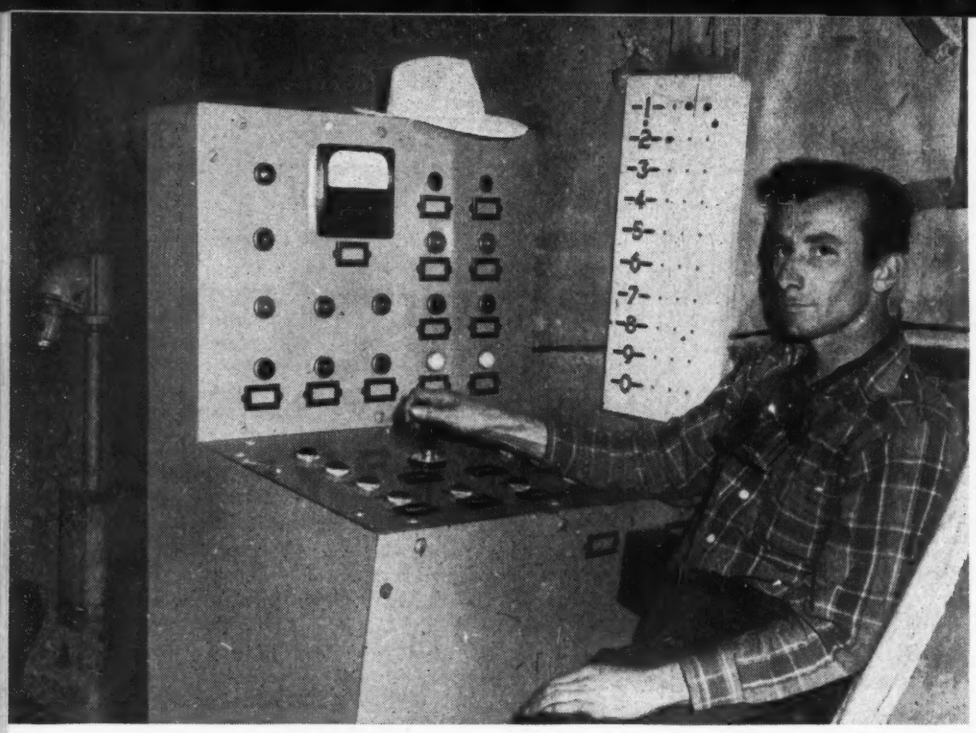
Flowsheets have been simplified wherever possible, and larger units (in gravity concentration for example) and simpler circuits have been applied to cut down on individual attention by operators. To make operation easier, mills have been designed with all units on a single level or on two levels. Examples of such mills are: the Bullfrog of U.S. S.R.&M. Co., the Treasury Tunnel of Idarado, the Sidney Mining Co. in the Coeur d'Alenes. When pumps or elevators do the stair climbing for the operators, fewer men may cover more territory.

Automatic controls are increasingly applied to make mill operation easier, but more of that further on. Some units now even run entirely by themselves, as for example the large, and automatically controlled, tailing pumps of one operator, who reports that his "pumps look like Christmas trees, but they really are sweet machines."

Cheaper Ore. Concurrently with the search for cheaper methods, mines are seeking cheaper sources of ore, and of course the cheapest of all are apt to be tailing piles. The development of so-called pre-concentration processes has helped in this endeavor, for by using some fairly simple process such as Sink-Float or Heavy Media, subgrade rock may be converted into suitable mill feed. This has been the experience of Hecla with that company's Osburn tailings plant (*E.&M.J.*, May 1944), and many others. The most recent such operation is that of Pacific Bridge Co. near Park City, Utah, where Humphreys spirals are used as a pre-concentration step on about 1,500 tons daily of 10-mesh lead-zinc tailings. The spiral concentrate is then ground and floated. Performance data are not yet available. Incidentally, one other large installation of spirals is being erected, and two more coal-treatment plants are using them.

Flotation Research. Speaking of flotation reminds one that research in that field is effecting simultaneously an approach to and a withdrawal from practicality. It appears that the long-sought goal of selective collectors for non-sulphide minerals is in sight, but 17 years of research have still left unsolved the problem of why minerals float. Research and argument on flotation fundamentals have now soared so far off into the blue that only the protagonists know what is going on. Meanwhile, the ions continue to do whatever it is they do at mineral surfaces, and generally the right minerals somehow float, unblessed by precise definitions.

Hope For Non-Sulphides. Gregoire Gutzeit presented a paper (T.P. 2077) at last year's A.I.M.E. meeting in Chicago that was full of hints for the future. He studied chelate-forming compounds as flotation reagents, some of which yield excellent selectivity on non-sulphide minerals. In this connection, a research as interesting as



OPERATING A CRUSHER isn't what it used to be in this modern mill. The operator, shielded from dust and noise, keeps track of the dumping mechanism and the big gyratory through signal lights. Control is through pushbuttons and lever.

Dr. Gutzeit's in another laboratory has yielded amazing results in non-sulphide flotation, but until a few matters of chemistry, patents, ethics, and what-not are adjusted, the experimenters have to keep quiet.

Farthest advance in tin flotation thus far recorded was the work of Gaudin, Schuhmann, and others, on Bolivian tin ores. Most fruitful of their research was the work described in articles in *E.&M.J.* for December 1946 and January 1947. Selectivity in both soap and amine flotation of cassiterite, fluorite, and siderite is described therein, and the articles contain much of interest to all flotation men. As the authors point out, "the period of bulk flotation of non-sulphides is ending."

Iron-ore flotation has progressed amazingly in the last couple of years. I recently saw a test on some Mesabi classifier overflow using one of the American Cyanamid 800 Series reagents, and the results were beautiful. The froth was as good as any sulphide froth, and both recovery of iron and grade of concentrate were good. Iron oxides will float, but costs may be high and a big problem is turning the concentrate into the physical state necessary for blast-furnace feed. Sintering may be the answer, but I understand that some other form of agglomeration as a cheaper substitute for sintering is being sought in at least two laboratories.

Oxidized Ores. Copper oxides and silicates in particular are getting a lot of attention, mostly because the ores that are left are full of them. Magma Copper, for example, is going to have to float, or otherwise handle, a lot of chrysocolla ($CuSiO_3.2H_2O$) when it gets around to mining the San Manuel orebody, in Arizona. Chuquicamata, if it is equipped with a new sulphide mill, must then float or leach a lot of oxide mixed with the copper sulphides. Andes Copper Co., like most porphyry coppers, has been troubled by the high oxide content of its sulphide tailing for years but has found no solution. Incidentally, the staff at Andes found that there is more oxide copper in the ball-mill discharge than there is in the ball-mill feed, and they would like to discuss this with someone who has ideas about it. Several individuals or laboratories are working on flotation of copper or lead oxides, and much progress should with any luck be reportable next year.

Crushing and Grinding. Aside from the trend to oversize crushers already mentioned, there is little to note in crushing technique. A new crusher was introduced by Straub (*E.&M.J.*, May 1946, p. 102), which featured high capacity and low power consumption.

In grinding, some highly interesting work was recorded by T. K. Prentice on "Crushing and Grinding Efficiencies." (*Jrl. Chem., Met. & Min. Soc. of So. Africa*, Jan.-Feb. 1946). Mr. Prentice tested efficiencies of rock drills, gyratory crushers, stamps, and cylindrical mills as crushing and grinding media, and got results of 3.4, 32.8, 34.7, and 23.4%, respectively. In all cases about 80% of the total power available for grinding went to produce heat.

In the United States, grates continued to raise capacity when installed in overflow ball mills, 12% at Castle Dome, for example; and continued success was reported from a few mills using rod mills as crushers. The idea of ball rationing seems to have caught on. At Climax, for example, long experiment has indicated a daily ball ration of one part 2-in. to two parts 3-in. balls, by weight, replacing the former all 3-in. charge. The staff believes this to have increased ball-mill capacity about 6%, almost all of which has been reflected in lower grinding costs. The Nevada-Massachusetts Co. charges 40% 3-in. and 60% 4-in. balls, and many other companies have adopted similar schemes since the work on ball rationing at Ajo was reported by Barker and Lewis in an A.I.M.E. paper in 1941.

Ideas on ball composition vary widely, mostly according to location of mill and availability of scrap iron. One operator reports that chilled balls made in an electric furnace out of scrapped Army tanks and rifle barrels are the equal of balls previously made of ordinary scrap plus $10 worth per charge of alloy metals.

The United States Department of Commerce announced recently a report on the German *schwingmuehl*, a ball mill that jitters as it revolves so that the balls batter each other as they rotate individually and as a mass. It has been used for grinding pigments, talc, graphite, and tungsten carbide to extremely fine sizes. Savings in time and power are reported but capacity is probably low.

Dewatering. A startling statement was sent me by a friend who recently watched a demonstration of a cyclone-type coal washer and thickener brought to the United States by Dr. M. G. Driessen, of Holland, and described by him at a Fuels Conference in Philadelphia last October: "If the thing really works," said my friend, "our large thickeners could each be replaced by a cyclone small enough for one man to carry easily." I have since been trying to recall who it was who brought a cyclone-type thickener into the laboratory one day about six years ago and said exactly the

same thing without the "if." I even remember what the device looked like, but I can't recall what tests were made or how they came out. At any rate, Dr. Driessen's coal washer may have wide application, and further information on it will be welcome.

For desliming or similar work in such fields as iron-ore beneficiation, phosphate sand recovery, concrete sand production, fine coal recovery, The Dorr Co. recently designed the heavy-duty H-1 Hydro-separator. Shown in an accompanying drawing, the unit includes an automatic hydraulic lifting device for 3 ft. of rake lift when overloaded. Lifting is quick, but lowering is slow when excess load is relieved.

No innovations were recorded in filtration, although the most recent, the Peterson Synchro-Drum filter, is finding new uses for its special abilities. An iron-ore treatment plant reports satisfactory use of stainless-steel filter medium on a conventional drum filter.

Screening. Vibrating screens are being used more often to close grinding circuits for separations down to 48 mesh or so, especially where the valuable mineral is more easily ground than the gangue and might be overground, slimed, and lost in an ordinary ball mill-classifier circuit. Great satisfaction was expressed by a mill superintendent with a Tyler screen and 48-mesh stainless-steel cloth working in a circuit grinding tin ore at a mill in Bolivia.

Heavy Density. New installations of Heavy-Media process equipment included the Algoma operation north of Lake Superior and Holman-Cliffs plant of Cleveland-Cliffs. Sloss-Sheffield, in Alabama, is putting in a Heavy-Media separation plant, as is Canadian Refractories Co. to the north. Aluminum Ore Co. now employs Heavy-Media in its fluorspar plant near Rosiclare, Ill., and Shattuck-Denn has taken over and is operating the DPC Heavy-Media plant at Gila, N. M. A pilot Heavy-Media plant is operated by Potash Company of America in Carlsbad, N. M. Magnetite in saturated brine solution comprises the medium.

A $2,000,000 installation of the H&H Sink-Float type of equipment is planned for Consolidated M.&S. Co. of Canada's Sullivan concentrator, Kimberley, B. C. Ore will be crushed to about 1 in. underground and passed via a two-mile tunnel to a 500-ton-per-hour Sink-Float plant. Galena will be the medium; sink will go on to the concentrator, and float will return to the mine as back filling.

At Eagle-Picher's Central mill, in Missouri, the heavy-density cone plant was recently equipped with a Bristol 24-hr. recording meter connected with two tubes of different lengths immersed in the ferrosilicon medium in the cone. The meter's chart is calibrated to indicate the pressure differential between the two tubes in terms of the gravity of the medium. Also tested at the Central mill was an Akins separator to treat minus-1½-in. plus-¼-in. cone plant feed with ferrosilicon as the medium.

Results indicated that the Akins machine has definite possibilities, and can be considered for treatment of lead-zinc ores by means of heavy-density methods.

Continuing the development begun two years ago, two Heavy-Media plants on the Mesabi Range have been converted to use Akins separators instead of the cones formerly used. Recoveries were said to be improved and operation has been simplified. Akins densifiers have also been tested on the Mesabi Range as substitutes for thickeners in preparing feed for the medium-cleaning magnetic separators.

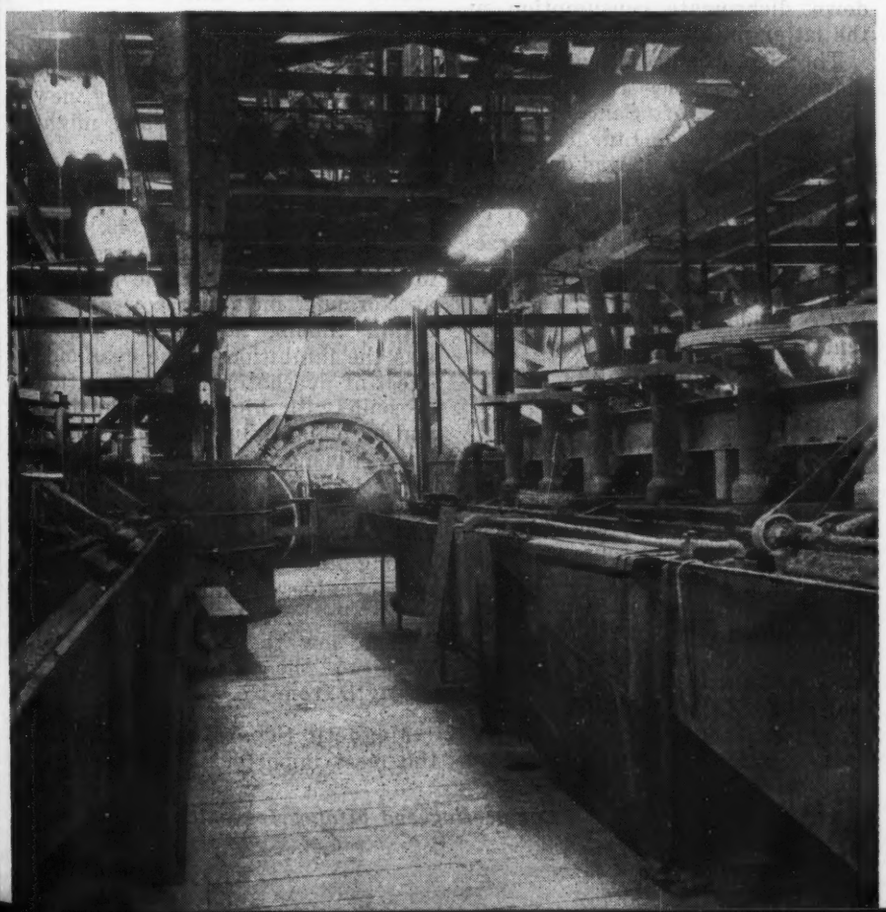
The new Stearns-Roger selective media concentrator, developed in tests on the Mesabi Range, is said to be working successfully. Using the iron ore itself as the heavy medium, the device produces high-grade concentrates from feeds as fine as minus-6 mesh. It was described by H. L. McNeill in an A.I.M.E. paper, T.P. 2084.

See also News, p. 119.

Western-Knapp Engineering Co. announced recently a semi-portable Heavy-Media plant complete in every respect. It will serve as a pilot plant, or can be hauled about from place to place in a clean-up operation on old mine, or tailing, dumps. Its capacity is up to 15 tons per hour, depending on the nature of the feed.

Flotation Machines. Judging by the quantity of surgery on flotation machines observed by our editors in various mills these past two years, mill men are acutely conscious that their machines could be better than they are. We have seen all sorts of baffles and distributor plates put into cells, and it is no longer uncommon to see one type of impeller hung on the shaft of an entirely different make of machine. Sometimes this home-tailoring

ALL ON ONE LEVEL is the milling equipment in the flotation plant of the Bullfrog mine of U.S.S.R.&M. Co. near Silver City, N. M. To control the entire lead and zinc flotation circuits from the ball-mill feed box on, the operators need not climb stairs or ladders.



produces results, as is apparently the case with the Fagergren machines used at Cananea, which are now wearing vaned "air screws" on each impeller shaft. These simple vanes force extra air down into the pulp, and the effect has apparently been to give better "emulsification" in the flotation cell. The practical effect there, and also at Morenci, where the same scheme has been tried, is that the reagents "take hold" faster and the copper floats nearer the head end of the line of rougher cells.

Apart from tinkering with the works, mill operators often come up with ideas on the less vital portions of their machines, as for example the concrete flotation cells at MacIntyre Porcupine. (For details, see p. 122 of this issue.) Bottoms of these 4-ft. Denver cells are poured in place; front and back cell panels are poured elsewhere and bolted into place. Partitions and gates between cells are of steel. Expanded metal reinforces the concrete. These cells cost about as much as the unavailable wood they replace, but it appears that they will last longer. In 16 months of operation, neither wear nor leaks have been apparent in the concrete cells.

No new flotation machine has been announced in the United States since the Massco-Fahrenwald came out over a year ago, but Lionel E. Booth has had a new design under test for some time, and details of it may soon be ready for release.

In passing, one might remark on the paradox that although flotation machines are so important to mining and are so widely used, there is great reluctance on the part of manufacturers to enter the field or to spend much on design changes if they are already in. Probably the cut-and-try and highly competitive nature of the business is the chief deterrent, but the facts still seem to indicate that opportunities are there for the man who can substantially improve flotation-machine design.

Flotation Reagents. Among new reagents one may mention Minerec 27, a produce of Minerec Corporation, New York. The reagent is intended for use as a sulphide mineral collector, and is said to be capable of producing improved metallurgy. Cost would probably be roughly the same as the reagents it would replace. Dow Chemical Co. is reported to have developed a benzamate reagent for use with copper ores.

American Cyanamid Co. reports wide use and testing of its new 800 series reagents with iron ore and various non-metallics such as feldspar, garnet, and silica. Improved results are reported over former fatty acid practice. The company's new reagent for use in copper-molybdenum separation is also being tested or used at several Western copper properties, where it is reported as giving good results.

Although the reagents are not new, the uses of reagents described in the Gaudin-Schuhmann article already mentioned (*E.&M.J.*, Dec. 1946, Jan. 1947) are well worth any flotation man's attention. One might again call attention to Gutzeit's paper (T.P.2077) and to the work of Kellogg on use of amines for sphalerite. Further than that, we can only hint darkly that there will be a lot more to talk about next year.

Flotation Processes. One of the most interesting applications of flotation has been to the three-way separation of copper, lead, and zinc minerals. At Fresnillo, in Mexico, Cerro de Pasco, in Peru, and other mills, $Na_2Cr_2O_7$ is used to depress lead so that the copper mineral can be floated away from it. Of interest is the variation in conditioning time at Cerro (*Min.&Met.*, June 1946); the Mahr concentrator is getting by with 5-min. conditioning with dichromate, but the Casapalca ore requires 4 hr. Prior thickening cuts down dichromate consumption at the latter mill.

The SO_2 practice used at some Mexican properties is typified by the flowsheet of San Francisco Mines of Mexico, Ltd. (*E.&M.J.*, May 1946), where it was developed Galena is depressed with SO_2 and chalcopyrite floats.

Still another variant is the practice at Eagle-Picher's Sahuarita mill, near Tucson, Ariz., where NaCN is added to a lead-copper concentrate to depress the copper and allow the lead to float.

The possible economic advantage of making these separations at the mill instead of being penalized or only partly reimbursed for the combined metals at the smelter was the driving force behind the development of copper-lead separations at most mills. A further example of the possible benefits is furnished by Golden Manitou Mines, Val d'Or, Quebec, where conditioning a lead-zinc concentrate for 75 min. with NaCN, $ZnSO_4$, and Na_2SO_3 permitted subsequent flotation of a good lead concentrate with increased grade of the zinc concentrate. (D. A. Livingstone, *C.I.M.M. Bulletin*, June 1946.) Economic benefit of this step was an increased revenue of $1.14 per ton milled.

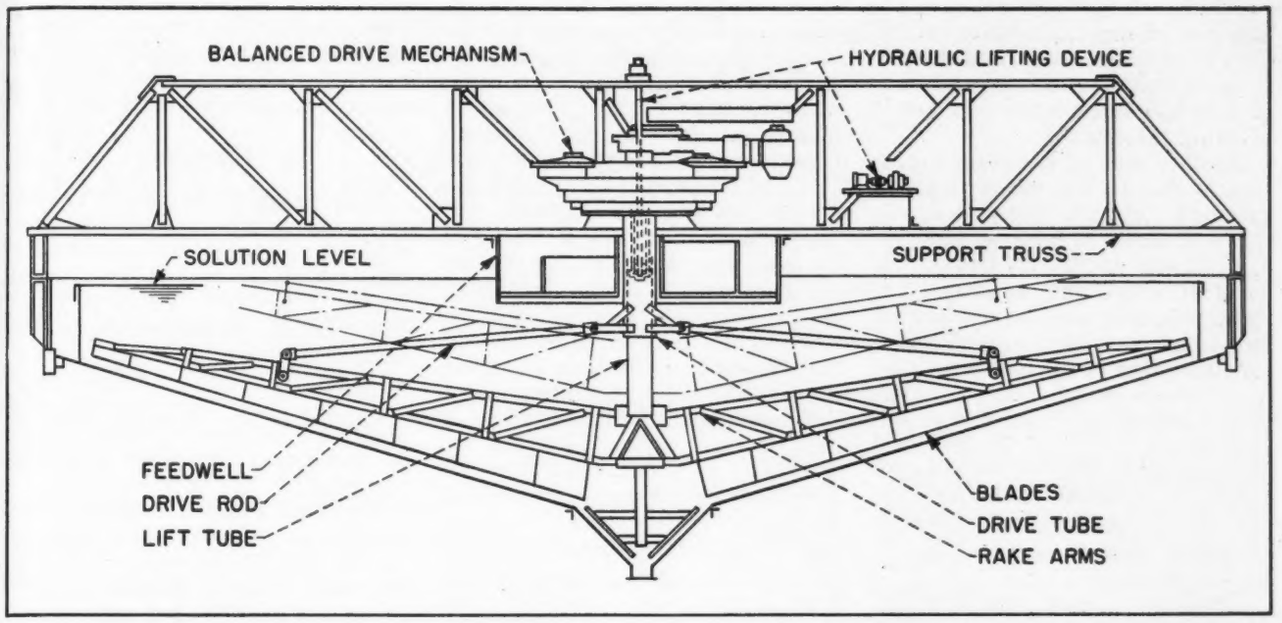
Heating flotation pulps is a not uncommon practice (for example, see *E.&M.J.*, Sept. 1946, p. 67), but the U.S.B.M. has new ideas about heat as a flotation reagent. At the last Denver meeting of the American Mining Congress, S. R. Zimmerley told about the Bureau's work on the differential surface effect of heating minerals, before flotation, to a range of 250 to 500 deg. C. Such heating enables, for example, pyrite to be floated while chalcopyrite is depressed.

Combined Metals Reduction Co., in Nevada, is reported to have something really new in the recovery by flotation of resins from Utah coals. These resins are subsequently refined for use in the plastics field. A pilot plant has been operating for about a year, and the commercial plant was expected to be in operation by now.

Cyanidation. The development of the Chapman dissolution and adsorption process for gold continues, as evinced by a paper presented by R. A. Hardy at the Denver meeting of the American Mining Congress. Gold, dissolved by cyanide, is precipitated at once on charcoal. At the Getchell mine, where the work described by Mr. Hardy was done, this gold-bearing charcoal could be recovered either by flotation or (lump charcoal used) by screening. Tests are still in the pilot-plant stage. Incidentally, new ideas on ion exchange resins might bring them into this picture.

Two excellent papers on cyanidation appeared in *C.I.M.M. Bulletins* for March and April 1946. The former, by McLachlan, Ames, and Morton, described cyanide practice at Noranda, including a wealth of detail. Among noteworthy points was the inhibition of the cyanicide effect of pyrrhotite by pre-aeration of pulp with high lime additions and by maintaining high lime alkalinity during cyanidation. In the April issue, Flin Flon's mill staff described the company's cyanide and regeneration plant practice. Among other things it was reported that cyanide consumption was cut materially by rationing NaCN additions, low to the first agitator, more to the second, and full-strength from No. 3 on.

Magnetic Separation. Probably the most important current devel-



HIGH TONNAGES of granular solids (100 to 1,000 tons per hour) can be removed from large flows of conveying water with Dorr's new Hydroseparator, built in sizes up to 100 ft. in diameter. Three rotating arms, rigidly attached to lift tube, hold rakes, and are driven by pivoted drive rods from drive tube. Rake lifting is thus free and vertical, and concentricity is maintained. Drive tube is rigidly connected to balanced spur-gear drive head. Tank-spanning support truss allows free center-cone discharge.

opments in magnetic separation are the preparations to treat Minnesota taconites by this method. One of the major Iron Range producers is now building the first unit of a magnetic taconite treatment plant that should begin operating in the spring of 1948. This plant will be large enough to furnish accurate cost data, although its production will not at first be of great significance. Plants of other operators are in the planning stage.

In preparation for this work, the technique of magnetic separation has been greatly improved. Two or three years ago a concentrate of 60% Fe was most difficult to obtain, and the 14% silica still in this product made it unsuitable for blast furnaces. Now, by combination of grinding, classification, and magnetic separation, concentrates up to 66% Fe can be secured on an economic basis. The Dings Magnetic Separator Co. has developed a new machine for this work.

Liberation of iron in treating taconites requires about 200-mesh grinding, and until recently it was thought the grinding costs would therefore be prohibitive. However, taconites seem to be ground comparatively easily, and, in addition, the Minnesota Mines Experiment Station, for example, has worked out some unusual grinding circuits that are said to reduce materially the cost of grinding. One feature of these circuits is reported to be the use of magnetic separators in much the same way as unit flotation cells are used in lead mills, or jigs in free-gold grinding circuits, to recover mineral as soon as free.

As mentioned previously, work is proceeding at the Mines Experiment Station, in the laboratory of Pickands, Mather Co., and probably elsewhere on agglomeration methods, other than sintering, that will permit use in blast furnaces of finely ground magnetic or flotation concentrates.

Automatic Controls. Work in the "Buck Rogers" department of milling is steadily advancing, and it should be possible right now, if anyone wants it, to devise an arrangement that would provide a continuous accurate record of the metal content of a mill tailing.

Automatic pH control, first reported from the Normetal mines in Canada (*E.&M.J.*, Aug. 1944, p. 76), is now in operation, and is being, or will be, tested at several mills, for example, Tennessee Copper Co., Nevada-Massachusetts Co., Combined Metals Reduction Co., and Chelan Division of Howe Sound Co., although the latter is now undergoing an eight-months' shutdown to let the mine catch up on development work. C. M. Marquardt, who handles electronic experimentation and geophysics at Combined Metals, is also working on an electronic pulp density controller for the company's grinding circuit.

Perhaps because it appears more amenable to automatic control than other unit milling operations, the grinding circuit has been given most attention. H. E. T. Haultain presented last year (*Can.Min.Jrnl.*, Aug. 1946) a summary of various grinding-circuit operating aids with which he has worked. He holds that indicating and recording devices as aid to manual control may be superior to completely automatic control.

However, the "automatic" plants increase. Mine & Smelter Supply Co. reports that its new automatic grinding circuit control has been working for over a year in a Colorado mill and is now perfected and ready for production. Called the Massco Circuitron, the device operates on a three-point control: the classifier density, the load on the classifier motor, and the sound of the ball mill. Data from these three sources are correlated within the Circuitron and translated into control of valves and of the new feed to the ball mill.

The grinding circuit at Utah Copper has been controlled for some time by automatic measurement of the height of the ribbon of classifier sand return, which in turn regulates the classifier rake speed. At Castle Dome, the grinding circuit is controlled by the load on the classifier, the aim being to hold a constant circulating load. Ball-mill feed is accordingly adjusted to meet

changes of ore, and water-control devices maintain constant density in the classifier. A tonnage increase of 3 to 5% is reported as a result of using the control.

Another sort of hands-off operation is that in Tennessee Copper's grinding circuit, described in *C.I.M.M. Bulletin* for Oct. 1946, by J. F. Myers and F. M. Lewis, mill superintendent and assistant, respectively. For each tonnage being fed, there has been worked out a corresponding valve pattern. The ore feeder is set, the valves are adjusted accordingly, and the grinding circuit is left to itself thereafter, until the feed rate is changed again. A modified Banks-Remington dilution gage and recorder (*E.&M.J.*, Aug. 3, 1926, p. 569) is used in this mill.

Tennessee Copper also probably has the distinction of being first to feed xanthate automatically (A.I. M.E. T.P.2083). A Leeds & Northrup continuous-conductivity measuring cell makes note of the classifier overflow condition (oxidation potential of the ore), and adjusts the xanthate feeder accordingly. Mr. Myers reports it to be working satisfactorily.

A simple but effective frother control has been working for some time in mills in the lead belt in Missouri. First tried at St. Joe's Bonne Terre mill, the device consists of a float in the pump sump to which the flotation middlings from several primary cleaners are returned. As the tonnage of middlings varies, the float fluctuates correspondingly, and thereby governs the speed of a frother feeder that adds reagent to the lead roughers to which the middlings are returned. Frother addition is therefore varied according to the tonnage of middlings recirculated. At first, the float controlled all the frother addition, but the time lag caused over-control, and about three-fourths of the frother quantity is now controlled manually and the rest automatically. As it is, the operators report that at times a month may go by without need to touch the frother feeders.

Placer Mining. Something almost revolutionary in placer mining will come into being late in 1947 when the first of the eight new tin dredges now being built for the Dutch Government goes into operation over on the island of Banka, N.E.I. The device is a simple Galigher pulp sampler, and each dredge will have four of these samplers to sample its jig tailings, which amounts to sampling the entire screen undersize. This is probably the first attempt ever to be made to take routine samples of dredge tailings, and is a development to be watched.

Six of the eight 14-cu.ft. dredges are being built in Holland; the two others are being built in Tampa, Fla. Much of the design and equipment comes from the Bucyrus-Erie Co. Powered by three 875-hp. diesels, the dredges can dig 100 ft. below water line, at a rate of up to 28 buckets per minute. The hull measures 246x76 ft., ladder is 216 ft. long; screen is 10x70 ft., driven by a 150-hp. motor through a 6-ft. drive roller. There will be 24 4-cell Pan-American rougher jigs, eight 4-cell secondary roughers, and two 2-cell cleaner jigs on each dredge. More than 600 Pan-American cells are being built under license in Holland for the dredges that are to be constructed there.

Apparently the feeling is growing among gold dredgemen that jigs should be installed on gold dredges as primary gold savers and not as scavengers following sluices. The most recent gold dredge to install jigs as the major recovery device is a 9-cu. ft. dredge in the West. Here 24 cells of 42-in. Pan-American jigs on 12 flowlines act as rougher jigs. The dewatered rougher concentrate is cleaned in two 2-cell 24-in. Pulsator jigs, the concentrate of which flows through a Titan amalgamator, where the gold is recovered.

Amalgamation. Speaking of the Titan amalgamator, one Western gold producer, who uses the Titan on concentrate made by jigs in his grinding circuit, was troubled by scouring of the amalgamator's plates. The rough, heavy mineral, plus a lot of tramp iron, often wore the plates right down to the copper. The difficulty was overcome eventually by simply covering each side of each plate by a rectangle of ½-in. by 18-gage expanded metal lath held on by three bolts and six clamp bars. Not only did this stop the excessive wear, but amalgam built up more evenly thereafter, and the clean-up is simplified in that when the expanded metal is removed, most of the amalgam comes with it.

Incidentally, this operator had for many years been certain that there was very little free gold in his ore. The grinding circuit jig installation was first made in 1938 and has since been revised and improved to the point where over the most recent six-month period, 58.2% of the total gold in the mill heads was recovered as amalgam, to the management's surprise.

Plants

With regard to new milling plants, something has already been said, for example in discussing Heavy Media, but there are several others in prospect. The new mammoth mill for Chuquicamata is still under discussion, although a small pilot flotation plant at the mine has for some time been testing sulphide ore. Judging by what I saw on a recent visit to the property, the sulphide concentrator may get away with a somewhat simpler flowsheet than others built recently for copper ores of the more truly porphyritic variety. Magma Copper Co. has a refurbished mill of increased capacity, but its metallurgists also have a problem in the form of the copper silicate in the San Manuel orebody, now being explored by Magma. Howe Sound plans a new 2,500-ton concentrator for its Snow Lake property, in Manitoba.

Newmont Mining Co., through O'okiep Copper, recently acquired from the Alien Property Custodian the rights to the former German Tsumeb mine, in Southwest Africa. The mine is now under water, but milling can begin on dump ore fairly soon, and the copper-lead-zinc differential flotation required will make a nice problem. American metal and some English and African companies are with Newmont.

In the non-sulphide field, American Cyanamid will soon start, or just has started, an ilmenite flotation plant at Piney River, Va. The MacIntyre Development of National Lead Co., Tahawus, N. Y., recently began floating ilmenite in a 250-ton a day pilot plant designed to catch fine ilmenite lost by its gravity plant.

In Florida interest centers about the fine new Noralyn phosphate flotation plant of International Minerals & Chemical Co., the foundations for which are now in. Coronet Phosphate Co. is planning a new flotation plant in which the company's unique belt flotation machines (*E.&M.J.*, Dec. 1942, p. 51) will be used for the coarser sizes of mineral. Other new phosphate flotation plants in Florida are in plan, and it is reported that all will use the "double-action" float worked out at International's Peace Valley

(*Continued on page* 169)

Non-Metallics Continue in Strong Demand

G. RICHARDS GWINN, Mineral Economist, U. S. Bureau of Mines, and
WILLIAM H. WAGGAMAN, Mineral Technologist, U. S. Bureau of Mines

Production of non-metallic minerals for the agricultural, heavy-chemical, metallurgical, construction, ceramics, and glass industries appears likely to maintain its present high level throughout 1947 or longer. Increasing utilization in place of metallic products is indicated.

AS VISUALIZED a year ago in the *E.&M.J.* annual survey, a number of the non-metallic industries operated at an accelerated pace in 1946, and there is evidence that production will continue at a high level during the next year or more unless labor difficulties hamper mining and manufacturing developments.

Metals and the non-metallic minerals are so interdependent in our modern economy that a rise or fall in the consumption of one inevitably affects the other. Large-scale economic mining operations, for instance, can be effectively conducted only with the aid of power-driven metallic tools, yet the metal in such tools is produced in furnaces lined with non-metallic refractories and by the use of non-metallic fluxes, such as limestone, fluorspar, and cryolite.

There is no question that the increase in agricultural output so urgently needed by an undernourished world depends upon the production of huge tonnages of non-metallic minerals carrying potash, phosphoric acid, and nitrogen. It is also true that salt, limestone, and sulphur are the basic raw materials for the heavy-chemical industries; but the mining, crushing, screening, processing, and distribution of these materials and their products cannot be effected without the aid of metallic equipment.

War, however, necessitated partial substitution of certain non-metallics for the strategic metals and organic materials needed in abnormal quantities for military use. Such non-metallics were employed chiefly for structural and insulating purposes, but a much broader field has been opened up for some, assuring them new and permanent outlets. Moreover, our dwindling reserves of higher-grade metallic ores and forest products make it increasingly evident that we must utilize to greater advantage the more plentiful non-metallic minerals for purposes where resistance to weathering, corrosion, and high temperatures are factors of prime consideration.

In the following discussion the non-metallic minerals are grouped according to their main uses, although in many instances they are employed for other purposes little dreamed of a decade or more ago.

ABRASIVES. Under the heading of abrasives are grouped a multiplicity of natural and synthetic non-metallic products, ranging from silica sand, available in unlimited quantities at a dollar or so per ton, to relatively scarce industrial diamonds sold by the carat. Abrasives include some of the softest minerals, such as talc, whiting, and calcium phosphate, which are largely used for polishing purposes, as well as natural corundum, fused alumina, and a number of carbides characterized by their extreme hardness.

The market for industrial diamonds continues firm, and accumulated stocks have been largely depleted. The market is being supplied from current production, which has been stepped up to meet the demand. A number of schemes for the production of synthetic diamonds were presented to the Bureau of Mines during the war, but none of them offered enough promise to warrant extensive investigation, and there is no immediate possibility of manufacturing diamonds in competition with the natural stones.

Advances in the production of synthetic sapphires, however, are notable, and clear products of exceptional hardness are being manufactured by Linde Air Products Co. in various sizes and shapes for bearings, machine parts, ring gages, and other purposes where resistance to wear is of prime importance.

Boron carbide, termed "the hardest man-made product," is being manufactured by at least two companies in this country. It is being substituted for diamond dust for certain purposes and is also fashioned into molded and sintered shapes such as nozzles, making it possible to maintain the size of orifices through which hard materials are drawn or sprayed. So far, however, boron carbide has not been very satisfactory as a cutting tool, because of its brittleness. The Bureau of Mines is planning an investigation with a view to improving the toughness of this product.

BUILDING MATERIALS. The housing shortage and large backlog of deferred construction accumulated during the depression and war years have greatly stimulated the demand for building materials such as stone, cement, sand, gravel, clay, and gypsum. Moreover, the broad program for highway construction makes it appear likely that the demand for non-metallic structural materials will continue to be heavy during 1947.

FERTILIZER MINERALS. The shortage in crops in many European and Asiatic countries has created an

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ELEMENTAL PHOSPHORUS IS MADE from low-grade phosphate-bearing material in this electric furnace plant of the Monsanto Chemical Co. The phosphate muck, as it is called, is mined near by and is washed and sintered before going to the furnaces

unprecedented demand for agricultural minerals. Damage to mining, processing, and transportation facilities abroad has seriously affected production of these important commodities and placed an additional burden on American mines and manufacturing plants.

Phosphates. The production of phosphate rock increased in 1946 for the fourth successive year, reaching an all-time high. The bulk of the rock was used for the manufacture of ordinary superphosphate, but triple superphosphate and more concentrated types of phosphatic fertilizers are growing in favor, particularly where long hauls to consuming centers are involved.

The phosphate-rock producers in Florida, Tennessee, and the Western states have expanded their mining facilities and introduced more modern processing equipment. The International Minerals & Chemical Corporation has opened up a new mine and installed the largest dragline ever constructed. This machine, which weighs more than 1,200 tons, has a bucket capable of handling 1,900 tons of material an hour.

Two of the independent phosphate companies in Florida have changed hands: The Phosphate Mining Co., operating at Nichols, Fla., has sold its properties to the Virginia-Carolina Chemical Corporation; and the Southern Phosphate Corporation's holdings have been acquired by the Davison Chemical Corporation, of Baltimore, Md. The purchasers are large manufacturers of fertilizers.

The Bureau of Mines is continuing its investigations on the vanadiferous shales occurring interbedded with phosphate strata in Idaho, Utah, and Wyoming. This area contains the greatest known domestic reserves of vanadium. A method of recovering both phosphoric acid and vanadium oxide has been proposed, to consist of calcining and leaching a mixture of phosphate rock and the vanadiferous shale.

Potash Minerals. Potash mines in New Mexico and the brines from Searles Lake, in California, continued to supply the bulk of the domestic demand for potash salts, and produced an exportable surplus. The output of domestic potash in 1946 was probably close to that of 1945, when it reached an all-time record. Various estimates of our potash reserves have been made from time to time; the most recent, by S. H. Dolbear, was published by the American Potash Institute and places the resources of K_2O in the form of soluble salts at 358,000,000 tons.

CERAMICS AND REFRACTORIES (other than clay). During the war much progress was made in developing special types of ceramic products and heavy-duty refractories. The knowledge gained should be of great benefit to peacetime industries concerned with the use of such products.

The production of ordinary ceramic and enameled ware for civilian use, however, was rather severely curtailed in the war period, and now that restrictions on such products have been lifted, accumulated needs are being reflected in a heavy demand for the non-metallics required for their manufacture.

Feldspar. This industry experienced a boom year in 1946 and expects to hold the new gains in output for several years. The expanding glass industry, the major user of feldspar, accounts for the greater part of the increased production. When the enlarged program of the enameling industry gets into full swing, additional demands will be placed on feldspar production. A new feldspar-grinding plant is being built in Colorado, and it is reported that a plant similar to the flotation mill at Kona, N. C., is under construction at Spruce Pine, N. C. Production is also reported from a new deposit in Georgia.

Talc. Synthetically bonded powdered-talc products and zircon ceramics have superseded in a large measure the market for block-talc products. The recent discovery of several talc deposits in Nevada, including one 8 ft. wide, has produced a boom in that area. Two companies, one in Texas and the other in California, have announced extensive expansion programs. Because of seasonal fluctuation of the waters of the Oswegatchie River, the International Talc Co., at Gouverneur, N. Y., one of the oldest nonmetallic mineral producers in this country, has shifted from direct water power to electricity. Conversion from manual loading and tramming of raw materials to mechanical loading and electric haulage has also been accomplished.

Glass. The technical achievements of the glass industry continue to expand as commercial applications follow closely the announcement of advances in the lab-

oratory. Uses range from special fiber-glass yarn employed to fill root canals in teeth to glass breaker-chutes utilized by the coal-mining industry. Fiber-glass in various forms and as the reinforcing agent in plastics has possibly made the greatest strides in 1946. It is claimed that fiber-glass-reinforced plastics provide a combination of properties highly desirable for use in the construction of automobile bodies and even in automobile bumpers. Experiments have been conducted toward producing a soluble glass for fertilizer purposes from mixtures of rock phosphate, potassium carbonate, and silica. Such a product would provide two of the elements necessary for plant growth.

Kyanite and Sillimanite. Investigation of the massive kyanite of Georgia, the sillimanite of North Carolina, South Carolina, and Georgia, and the blending of this kyanite and South Carolina topaz, are perhaps the most important features of the kyanite minerals industries in 1946. Massive kyanite is good material, but there is some doubt as to whether it will be found in commercial quantities. Large tonnages of sillimanite are indicated, but it is believed that there are only a few deposits rich enough for commercial development. Bureau of Mines studies have shown that this sillimanite can be made into firebrick, without previous calcination, for service up to 1,600 deg. C.

INSULATING MATERIALS. The broad term "insulators" includes materials that prevent or retard heat losses, short-circuiting or leakage of electric currents, and transmission of sound waves. In all these fields the non-metallic minerals are playing essential and increasingly important roles, displacing organic substances that decompose at high temperatures and constitute a fire menace.

Asbestos. Large demands for asbestos were made by the construction and automotive industries in 1946. Production in Canada and Africa, two of the world's major sources, increased during the year. Production of tremolite and some long-slip-fiber chrysotile from the Alaskan deposits in the Dahl Creek area, Kobuk River district, also is reported.

The Arizona chrysotile deposits and mill of Roger Q. Kyle have been purchased by a mining group that plans operations on a much larger scale. It is reported that the Johns-Manville Corporation of America has announced plans to manufacture asbestos products in ten foreign countries, including Great Britain, France, Mexico, Argentina, China, and the Philippines. New asbestos deposits in the Lewis Brook area of Newfoundland are being opened by the Asbestos Corporation, Ltd., which operates deposits at Thetford, Quebec.

Mineral Wool. The mineral-wool industry, like many other non-strategic industries handicapped during the war period because of inability to get equipment or replacement parts, began wide expansion programs in 1946. This industry's position was unusual in that the wartime program to save fuel brought to the general public the real value of insulation, but the exigencies of war prohibited allocation of equipment and replacement parts to the mineral-wool plants. In 1946, however, a widespread expansion program was begun. Approximately ten new plants are in production or in the process of construction, and several other plants have expanded.

Vermiculite. As one of the lightweight aggregates, vermiculite is in great demand by the construction industry. Suggested new uses are insulating refractory brick and block, and insulating block for cold storage and non-load-bearing partition tile. It is also reported that the production of fabricated shapes made of expanded vermiculite and concrete, which can be sawed or nailed and have a smooth surface for painting, began at a plant in Knoxville, Tenn., in 1946.

Mica. The major interest in the domestic mica industry in 1946 seems centered on large-size sheet and on ground mica. This, of course, is natural because now that the subsidized prices have been removed, only large-size sheet and wet-ground mica bring prices that can compete with those for imported mica. It seems apparent that unless mining is planned more systematically and adherence to wartime trimming practices continued, mica mining in the United States will revert to prewar levels and will survive only as a byproduct of the feldspar industry. The Bureau of Mines has issued reports on mica districts in Latah County, Idaho; San Miguel County, N. M.; and Alabama.

Additional research is being carried out to find substitutes for mica. Some substitutes have reached the stage of serving as successful alternate materials. Spun and fibered glass has recently attracted attention. The Germans have successfully produced synthetic mica in the laboratory (*E.&M.J.* June 1946, p. 162), but so far it is not being produced on a commercial scale. A recent report by Paul M. Tyler estimates the cost of synthetic mica at about ten times that of the natural product.

HEAVY-CHEMICAL MINERALS. The production of non-metallic minerals used in metallurgy and the heavy-chemical industries was pushed to an all-time high during the war, and though military demands have now greatly decreased, accumulated civilian needs are keeping production well above prewar levels.

Limestone. Curtailment in the output of iron and steel, due both to termination of the war and a series of strikes, caused a drop in the production of metallurgical limestone in 1946. The consumption of lime also fell off about 4%, since the demand for products made through the medium of lime was somewhat less than in the previous year and the building program had not yet gotten into full swing.

Fluorspar. Although the production of domestic fluorspar fell about 22% in 1945 and decreased again in 1946, the average rate of production since May 1946 has shown a distinct upward trend. The total consumption during the past year was fully 75% greater than before the war.

Enamels, ceramics, and certain glass products (large consumers of fluorspar) more than held their own during 1946, and the wider use of anhydrous hydrofluoric acid as a catalyst and for the manufacture of fluorine compounds offers new and expanded markets for acid-grade fluorspar.

Sulphur. For the past eight years the consumption of domestic sulphur has mounted steadily. Approximately three-quarters of the total tonnage is consumed in the manufacture of sulphuric acid, which in turn is used in the processing, manufacture, and refining of innumerable finished products.

Any decrease in the military demands for sulphur has been more than offset by civilian requirements in the postwar period. Among these uses, the continued increase in the production and consumption of superphosphate for fertilizer pur-

(*Continued on page* 138)

Research Widens Field for Iron-Ore Beneficiation

GROVER J. HOLT, Chief Engineer, Mining Department, Cleveland-Cliffs Iron Co., Ishpeming, Mich.

Expansion of iron-ore concentration in the Lake Superior district during 1946 made little headway in the face of hampering factors. The increase in ore price, mitigated by higher transportation charges, is still inadequate to stimulate all-out development of low-grade ores requiring concentration. Much research is being directed to the problem of concentrating fine sizes of ore. Experimental work on taconite concentration continues on an extensive scale. Use of flotation is extended in pilot plants.

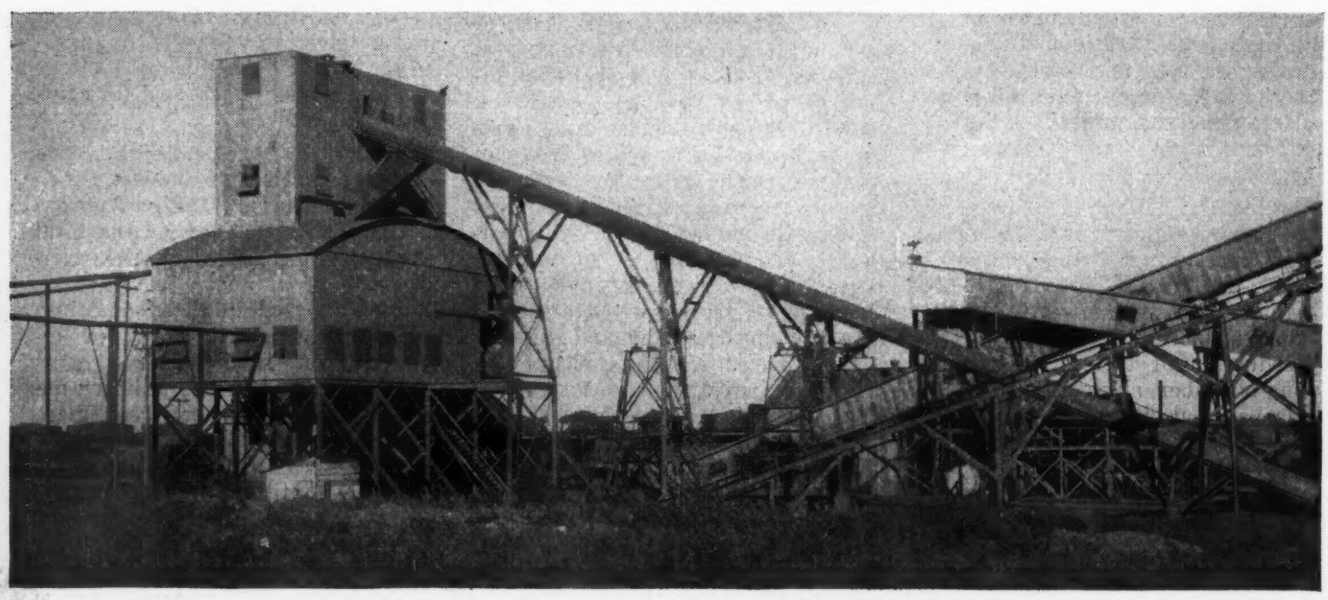
THE IRON AND STEEL INDUSTRY of the United States has been extremely fortunate in the past in having a supply of high-grade ore ample to fulfill its requirements. The backlog of this high-grade production has for years been the open pits of the Mesabi Range. Iron-ore concentration on the Mesabi, after slow development over a period of years, has become a substantial factor and has taken a permanent place beside the high-grade open-pit production.

It is interesting to note that in the five-year period, 1936 to 1940 inclusive, a total of 158,000,000 gross tons of open-pit ore was shipped from the Lake Superior district in the form of direct ore and concentrates, and in the war period, 1941 to 1945 inclusive, this open-pit production was increased 100% to 316,000,000 gross tons. Underground iron ores shipped during the same five-year periods varied from 80,000,000 tons during 1936 to 1940 inclusive to 102,000,000 tons during the 1941 to 1945 period, an increase of only 27.3%. During this latter period, the proportion of open-pit concentrates in total Lake Superior shipments varied only between 18% and 20%.

Plant Capacity Exceeded

In the last ten years the open-pit concentrates shipped from the State of Minnesota have varied from 19% to 25% of the total shipments from the State. These figures indicate that the concentrating plants of the Lake Superior district were able to hold their own with the high-grade open pits in increasing production by 100% during the emergency. This was accomplished not by building new plants but by pushing capacity of existing plants far beyond the economical limit.

The operator of high-grade open-pit iron mines today is concerned largely with mining problems and only to a minor degree with bene-



Evergreen iron ore sintering plant of M. A. Hanna Co. at Crosby, Minn. on the Cuyuna range—outstanding among Iron Country beneficiation plants

ficiation of product in the form of crushing and screening. The producers of open-pit concentrating ores must face not only the same problems in mining but must also work out their salvation in mineral dressing involving crushing, screening, sink-float, jigging, tabling, magnetic separation, or other hydraulic or gravity processes to improve the grade of the ore.

Cost Is Limiting Factor

It is evident that the limit to which iron-ore concentration may be carried is purely a matter of economics. With sufficient skill and effort, but without regard to economics, almost any iron-bearing rock may be treated to produce an ore which can be made into iron and steel, but the price of the product would in most cases be prohibitive. From the standpoint of economics, the early and continued use of the higher grade iron-ore deposits is understandable, and the slow development of orebodies which require concentration has been evident. This has resulted from the fact that iron ore in the form of concentrates, having an equal iron content, is sold at the same price as an ore which has been mined and shipped direct without concentration. In 1946 much consideration was given to the depletion of high-grade reserves and the replacement of these reserves by the development of processes which could utilize the huge reserves of low-grade iron formation.

The Mesabi Range lays claim to the major part of the 1946 concentrate production. Here the concentration of hematite ores is mainly carried out in plants utilizing a "straight wash" flowsheet. This flowsheet involves a sizing operation for the elimination of waste. The equipment used is made up of crushers, screens, log washers, and classifiers. The silica elimination occurs in the fine classifier overflows.

The potential loss of fine iron, mostly minus 65 mesh, which is overflowing these classifiers is receiving greater attention than ever before. During 1946 26 Hydrosizer units and 2 Hydrotator units were adding production to plant recovery from these sources.

In 1946 straight-wash plants were maintained at the properties of 28 companies listed in the accompanying table.

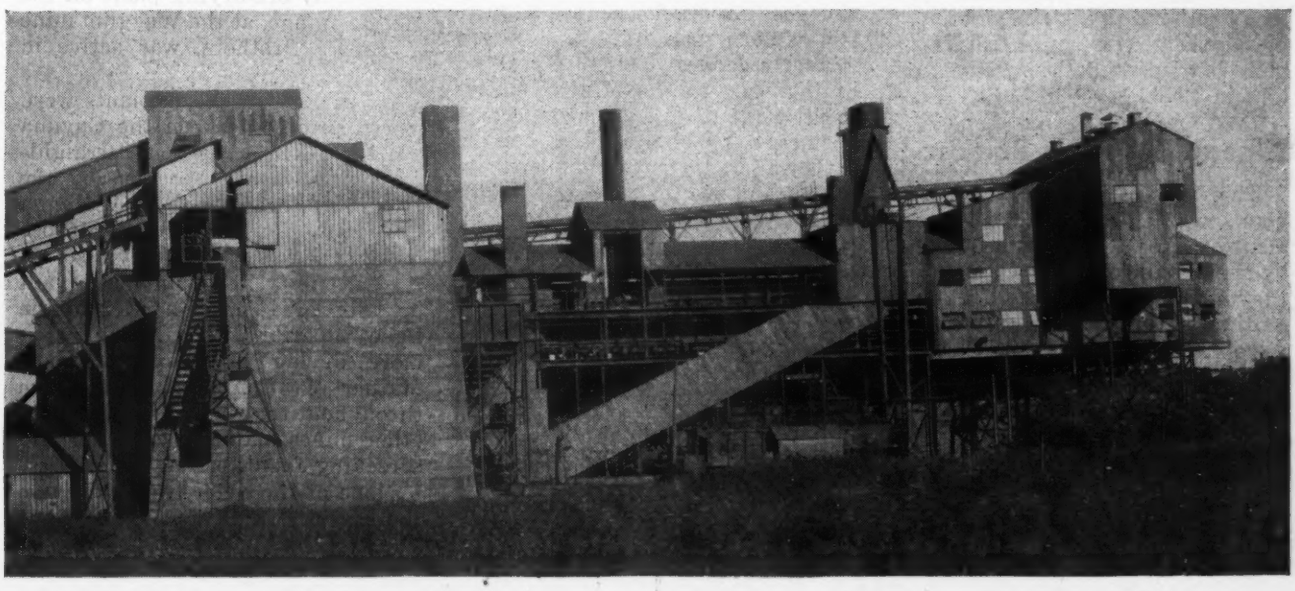
Generally as straight-wash orebodies, and frequently as merchantable orebodies, approach exhaustion, the ores are contaminated with coarser rock in all particle sizes. The fine silica which can be eliminated by a sizing operation is still removed by the straight-wash flowsheet, but sink-float, jigging, or other means must be used to remove the rock in a follow-up process to offset the resultant decrease in recovery of concentrates. As a rule sink-float is used on the coarser fractions from 1½ in. down to $\frac{3}{16}$ in. (with a trend toward plus ⅛ in. on the fine side), and double classification or selective media concentrators on the undersize. Jigging is done at present on unsized feeds.

In the coarser sizes (from 1½ in. down to $\frac{3}{16}$ in. or ⅛ in.) concentration as a rule is not extremely difficult where the ore and waste are liberated. Below these sizes lies the fertile field for research and development of equipment which can make a clean separation and avoid mechanical entrainment of free silica particles in the otherwise clean concentrates. It is in these sizes that the major part of the silica enters the concentrate from the plants now in existence. A true heavy liquid which could be used economically in a sink-float process would be ideal, but none is in existence today to provide the economical operation necessary. Hydraulic and gravity processes have proved economical but not as efficient as required.

If hydraulic or gravity processes are to work successfully on this fine ore, the size range of $\frac{3}{16}$ in. or ⅛ in. down to 100 mesh appears to be too great. Screen sizing to reduce this range of fine particle sizes is not attractive, due to the heavy tonnages to be treated and the lack of screening efficiency at the fine sizes involved. The hydraulic and gravity methods of treatment are also becoming less attractive with the increase in true middling as the structure of the ore becomes more complex.

Grinding Vs. Crushing

It appears evident from research work done to date that the possible solution of the metallurgical problem involved in the treatment of these fine sizes lies in the difference in grindability of the ore and waste. The ore particles are as a rule relatively hard and dense and the waste is relatively soft, or loosely cemented, and quite friable. Tests have shown that in using a ball mill



on these sizes with light ball charges, the major part of the rock particles can be ground to a size which will overflow the conventional classifiers used, without grinding the iron particles excessively.

Future plant developments may well incorporate this idea of abrasion grinding by the substitution of rod mills to replace coarse-crushing equipment, thereby combining coarse crushing and abrasion grinding in one unit. Butler Brothers and the Oliver Iron Mining Co. conducted plant tests on abrasion grinding in 1946, and a unit is being installed by the Mesaba Cliffs company for use during 1947.

It is in the treatment of fine sizes of ore that the greatest changes of plant flowsheet have been found necessary to date. Continual research and testing are necessary.

During 1946 plants utilizing sink-float combined with fine-ore treatment and jigging were in operation as shown in the table.

Mesabi Range Plants Utilizing Straight-Wash Flowsheets

Name of Property or Plant	Operating Company
Aromac	Butler Brothers
Galbraith	Butler Brothers
Weggum	Butler Brothers (includes ore-drying plant)
Harrison	Butler Brothers (includes ore-drying plant)
Patrick	Butler Brothers (includes ore-drying plant)
Canisteo	Cleveland-Cliffs Iron Co.
Hill-Trumbull	Mesaba Cliffs Iron Mining Co.
Holman Cliffs	Mesaba Cliffs Iron Mining Co.
Bennett	Pickands, Mather & Co.
Corsica	Pickands, Mather & Co.
Danube	Pickands, Mather & Co.
Argonne	Evergreen Mines Co. (M. A. Hanna Co.)
Buckeye	Evergreen Mines Co. (M. A. Hanna Co.)
Douglas	Evergreen Mines Co. (M. A Hanna Co.)
Draper Annex	Hanna Iron Ore Co.
Mesabi Chief	Hanna Ore Mining Co.
Wabigon	Hanna Ore Mining Co.
Prindle	Oliver Iron Mining Co.
Trout Lake	Oliver Iron Mining Co.
Columbia	Inter-State Iron Co.
Grant	Inter-State Iron Co.
Hill-Annex	Inter-State Iron Co.
St. Paul	Republic Steel Corp.
Webb	Snyder Mining Co.
Hawkins	International Harvester Co.
York	York Mining Co.
Sullivan	Rhude-Fryberger & Leach
Commodore	E. W. Coons Co.

One of the principal recent developments in the use of the sink-float process on iron ore has been the substitution of Akins concentrators for the rising-current type of iron-ore cone. This concentrator is actually a heavy-duty spiral classifier containing the medium with a rearrangement of ore inflow and tailing outflow. The concentrates are raked out of the bottom of the relatively quiescent pool with but little medium, thereby cutting down on the amount of the medium circulated, with a resultant saving in power consumption. Metallurgical results show improvement, and this development opens the field to a treatment of the finer sizes of ore which were carried out of the old closed-top, iron-ore type cone. Butler Brothers' Patrick plant and Mesaba Cliffs company's Hill-Trumbull plant utilized these concentrators in 1946.

Cheap Reagents Required

The use of flotation in pilot plants was extended for the treatment of classifier overflows in 1946 by the installation of such a unit at the Danube mine of Pickands, Mather & Co. Former pilot plants were in operation at the Canisteo plant of the Cleveland-Cliffs Iron Co. and the Patrick plant of Butler Brothers.

What part flotation will play in the future of iron-ore concentration has not yet been determined. It seems safe to predict, however, that it should find a permanent place in concentration of hematite ores. There is no doubt that more grinding is indicated in future production with the creation of a greater tonnage of classifier overflows to which the process seems well adapted. Cheaper reagents will be required than are called for in the non-ferrous industry, where the percentage of mineral to be floated is relatively small.

In the grading of iron-ore concentrates for shipment, some indication of the concentration characteristics must be available before actual mining and treating take place, and to accomplish this, drilling and hand-sampling of banks in the pits are important. The treatment of these samples has developed into a problem of such magnitude that where formerly carload lots were shipped at intervals to the Mines Experiment Station, it has now become necessary to obtain data quickly rather than to move shovels about the pit and use the production plant as a test unit.

Extensive laboratories are maintained by Butler Brothers, Pickands, Mather & Co., Mesaba Cliffs company and the Oliver Iron Mining Co. In these laboratories miniature flowsheets can be established and complete plant data predicted quite closely without interfering with production. Where necessary, information on carload lots is checked by the Mines Experiment Station, which provides the advantages of a centralized pilot plant.

Some of these laboratories are also working on the problem of concentration of taconites containing both magnetic and non-magnetic iron. Work on these taconites has been conducted by the Mines Experiment Station for years and more recently the Battelle Institute has also been conducting test work.

The Mines Experiment Station is at present actively following up the agglomeration work on fine ores to replace sintering, and is also making a detailed study of various concentration processes.

The Reserve Mining Co., at Babbitt, Minn., continues active work on the concentration of eastern Mesabi magnetic taconites, and during the year 1946, in conjunction with The Linde Air Products Co., worked out the fusion-piercing of iron formations to replace the slower method of churn drilling.[1] It is reported that the heat used fractures the rock by means of setting up internal stresses, which in turn provide better fragmentation on blasting. This may prove to be a decided aid in ore concentration by lessening the crushing load in the plant prior to grinding and concentration.

New Plants Considered

Magnetic roasting and magnetic concentration are under consideration for the treatment of hematites. The economy of this process will depend on a cheap source of fuel for heating and reduction.

A plant for the production of powdered iron from iron carbonate formation is now under erection by the State of Minnesota, and should be in operation in 1947.

The only ore-drying plant on the Mesabi Range, at the Weggum mine of Butler Brothers, was active in 1946.

No new beneficiation plants were placed in operation on the Cuyuna Range in 1946. At present "straight-wash" plants are operated by the Evergreen Mines Co. (M. A. Hanna Co.) at the Portsmouth and Maroco mines. The same company also operates the only mine sintering plant in the United States portion of the Lake Superior district. The Sagamore drying plant of Pickands, Mather & Co. was also active throughout the year. Several of the other mines maintain crushing and screening facilities only.

None of the other iron ranges on the American side of the border has

[1] See E.M.&J., Nov. 1946, p. 66.

as yet gone into the active concentration of iron ores or iron formation. However, Jones & Laughlin Steel Corporation is erecting a laboratory on the Marquette Range to be used in the study of this problem, and the Cleveland-Cliffs Iron Co. has been conducting tests on the concentration of Marquette Range jaspers.

On the Canadian side of the border, three beneficiation plants are in operation. The Algoma Steel Corporation operated a sink-float plant during the 1946 season, this plant having the largest capacity of any single-unit sink-float plant in the iron-ore field. Siderite concentrates as well as crude siderite are sintered at Algoma's Wawa, Ont., sintering plant. Algoma is currently producing ore for concentration from its new Victoria open pit, but is also opening up a new underground development below the old Helen open pit. Part of this underground ore will be concentrated. Steep Rock Iron Mines, Ltd., operated a washing plant during the 1946 season, handling lump and coarse ores. Michipicoten Iron Mines, Ltd., operated in 1946 the only jig plant in the Lake Superior district on the underground production of hematite, from the Josephine mine. This mine is closed at present due to a cave-in of mud from the old lake bed that lay over the property.

NEW YORK. As in prior years, New York State production is largely derived from plants using magnetic concentration processes. The Republic Steel Corporation produced concentrates and sinter from the Chateaugay, Fisher Hill, Harmony, and Old Bed properties in 1946. The Hanna Coal & Ore Corporation production of concentrates and sinter came from the Clifton mine, and Jones & Laughlin was actively working at the Benson mine, having taken over the concentration plant on the property from the D.P.C.

PENNSYLVANIA. Bethlehem Steel Co. in 1946 operated its magnetic concentration plant on ore received from the open-pit and underground divisions of the Cornwall property.

NEW JERSEY. The concentration plant at the Scrub Oaks mine of the Alan Wood Steel Co. produced concentrates by means of magnetic separation, jigging, and tabling throughout 1946.

Warren Pipe & Foundry Corporation operated its magnetic concentration plant on underground ore from the company's Mount Hope mine in the Dover district.

ALABAMA. The Spaulding concentrator of the Republic Steel Corporation continued production through 1946. Gravity concentration, mainly involving the use of tables and classifiers, makes up the flowsheet. At Russellville, open-pit ores were washed in log washers by the Sloss-Sheffield company. Shook and Fletcher, as well as Wade and Richie, produced open-pit ores concentrated by log washers. The Tennessee Coal, Iron & Railroad Co. sintered the finer portion of underground production in 1946. Woodward Iron Co. mixed the fines from underground production with flue dust for sintering.

MISSOURI. The Iron Mountain concentrator of the Ozark Ore Co. (M. A. Hanna), using mainly jigs, produced a substantial tonnage of concentrates in 1946.

TEXAS. The plant of the Lone Star Steel Co., at Daingerfield, utilizing sink-float calcining of siderite and sintering of limonite, was inactive during last year. The Sheffield Steel Corporation's washing plant in the North Basin has been leased by Peter M. Chamberlain, who entered the production list in 1946.

Higher Price Needed

The principal drawback to an extension of the commercial application of concentration to low-grade iron ores and iron formations in recent years has been the reduction in the price of iron ore which took place in 1940. This reduction came into effect at a time when labor and materials were rising and was maintained throughout most of the war period. In 1945 the OPA granted an increase of 20c. per ton on underground ore and 10c. per ton on open-pit ore, whether concentrated or shipped direct. In 1946 the price of all iron ore was increased 50c. per ton, but 13c. of this was deflected into an increase in transportation charges. In attempting to offset increased labor and supply costs against advances in the price of iron ore, the operator of an iron mine, where ore required concentration, could only end by concluding that he was in worse condition in 1946 than in 1940.

To date only the best of the open-pit concentratable ores can be treated. Nevertheless, substantial strides have been made in Minnesota, where in 1909 only about 43 thousand tons of concentrates, representing 0.1% of total shipments, were made, as against 15 million tons of concentrates in 1945 or 25% of the total shipments from the State.

Plants Utilizing Combined Sink-Float and Fine-Ore Treatment

Name of Property or Plant	Operating Company	Process Used
Harrison	Butler Brothers	Sink-float, double classification
Patrick	Butler Brothers	Sink-float, double classification
Hill-Trumbull	Mesaba Cliffs Mining Co.	Sink-float, selective media
Buckeye	Evergreen Mines Co. (M. A. Hanna)	Sink-float
Hawkins	International Harvester Co.	Jigging
Danube	Pickands, Mather & Co.	Jigging

Strike Hinders Expansion

The costly strike in the Lake Superior district in 1946 also discouraged prospective capital investments in increased plant facilities, and, as a result, expansion of concentration plants during the year was almost negligible. There is the hope that once the law of supply and demand again begins to function normally, the steel industry will survey the havoc of war depletion of iron-ore reserves within the nation, and establish a price for iron ore which will encourage the development at an early date of ore reserves requiring concentration, with necessarily higher cost of production.

We will not win another war on the high-grade open-pit ores of the Mesabi Range if our peacetime expectations assume another twenty-year production in the interim. The coming year should be one in which long-range planning is resumed. With our future place in the nations of the world depending, as it has in the past, on our production of iron and steel, surely an increase in iron-ore concentration should be assured.

The assistance of staff members of the various operating companies in compiling the information on their operations is gratefully acknowledged.

Non-Ferrous Metallurgists Cut Costs and Slag Losses

CARLE R. HAYWARD, Professor of Process Metallurgy, Emeritus, Massachusetts Institute of Technology, Cambridge, Mass.

With labor productivity declining in most plants, smelters are testing mechanical devices to increase capacity. Possible improvements in copper casting are suggested and copper slag washing is described.

WITH DEMAND far exceeding supply, and with good prices available, the outlook for most of the nonferrous metals has improved in recent months. The labor situation, however, hangs like a dark and threatening cloud over the industry, and is the principal topic of conversation in the executive offices of practically every company. The beneficial effects of technological improvements can easily be neutralized by unhappy labor conditions, and it is not strange that operators are deeply concerned regarding the future.

Labor-Saving Devices

In this review last year it was stated that mechanical tuyere punching of copper converters was being perfected. It can now be stated that it has arrived. Two companies working along slightly different lines have attained success. One method has an attachment that operates on the entire tuyere belt, and the other operates on each tuyere independently. Success seems to depend on very rapid insertion and withdrawal of the punch bar, thus allowing insufficient time for the slag or matte to solidify on the end. Although the operation may ultimately become completely automatic, there is at present one attendant compared with three men per shift in manual punching.

The oxygen efficiency in converter operation is high, so keeping the tuyeres continuously open is important if a high converting rate is to be obtained.

Another procedure for eliminating considerable hand labor is the casting of lead and blister copper into cakes weighing three to five tons to facilitate handling and shipping. This is by no means new but has only recently become common practice.

With a fraction of the former manpower, the metal is cast into large blocks and these are handled by cranes or mechanical hoists.

Because of increasing dissatisfaction with the performance of workmen, as well as of higher wage costs, it is fair to predict that the immediate future will see numerous other labor-saving innovations such as the foregoing.

Some of the deficiency in current production of copper, lead, and zinc can be made up by improved operating techniques, which may also result in cutting labor costs. As examples one may cite the methods being used to prolong the life of copper reverberatory furnaces and to minimize operating interruptions. The two most vulnerable parts of the reverberatory smelting furnace are the side walls along the slag line and the roof. Various methods have been used to minimize break-outs along the slag line, but it is doubtful if a better principle has been devised than that pioneered at Anaconda some years ago —viz., magnesite lining backed up by water jackets.

The practice of patching the interior surface of the roof with silica slurry by means of a gun spray, which was initiated by Phelps Dodge some years ago, has been adopted by many. Techniques for applying the patches have been improved, and it has been found that if strict watch is kept for thin spots, and patches are promptly applied, the roof life is greatly prolonged.

The alternative to the above procedure is the use of suspended arches of magnesite brick, developed at Noranda. As stated in a previous review, the suspended arch not only simplifies the replacement of roof sections and economizes in bricks but allows the use of wider furnaces with consequent fuel and refractory economies.

At least one plant has copied the Noranda practice with unsatisfactory results, due either to the characteristics of the magnesite brick used or, more probably, to the use of a more siliceous charge. Noranda has a high iron charge and low magnesite costs, which is favorable to that company's procedure. It would seem that wide furnaces and suspended arches could be adapted to silica roofs with some advantages where magnesite is undesirable or too costly. Certainly increasing labor costs and production demands are strong incentives to seek maximum uninterrupted reverberatory life.

Raw or Roasted Charge

The two most recent reverberatory furnaces built in the United States were designed for raw charge and are reported to be working satisfactorily. In both cases a fairly uniform concentrate is used, which is well suited to this operation. In a custom smelter where the charge may be subject to more variation it is probable that the older practice involving roasting will continue. It must be agreed, however, that the workmen prefer the general atmospheric conditions in plants using raw feed, where there is much less sulphurous gas and irritating sulphate dust about the furnaces.

Slag Losses

As the copper resources of the United States dwindle and prices begin to advance, it may become important to conserve these resources by minimizing slag losses. The idea of using pyrite for this purpose is not new, but thus far it has not been considered sufficiently economical. Some tests recently made under my direction by Philip N. Bowditch in the M.I.T. laboratories show some interesting facts.

The slag used in these tests was from a commercial reverberatory furnace and was found to contain 0.67% copper. The pyrite was a product from differential flotation of copper ore. It carried 49.4% sulphur and 4.8% insoluble.

The fusions were made in clay-graphite crucibles in an electrically heated furnace. The variables were: time of heating (30 min. to 2 hr.), temperature (1,100 to 1,500 deg. C.), amount of pyrite (1 to 10%), and two methods of adding the pyrite, one by mixing with the crushed slag before fusion and one by adding on top of the slag before fusion.

The results may be summarized as follows:

1. There was only slight reduction of copper under any of the above conditions at 1,100 deg. C.

2. Better results were always obtained when the pyrite was all added as a layer on top of the charge than when it was mixed with the crushed slag.

3. Increase in quantity of pyrite improved copper removal.

4. Increased temperature improved copper removal.

5. Using 10% pyrite as a layer and heating two hours at 1,300 deg. C. gave a final slag containing 0.04% copper. A half hour at 1,500 deg. C. gave a final slag containing 0.06% copper, and two hours at 1,500 deg. C. gave a final slag with 0.03% copper. The last-named figure represents a calculated removal of 95.5% of the copper in the original slag.

No analyses were made of the matte which was formed from these treatments.

The figures presented in the foregoing represent only a relatively few small tests, but they definitely show the effectiveness of pyrite sprinkled on the surface of a charge as a means for washing out the copper.

SUSPENDED-ARCH construction of copper reverberatories permits roof repairs without shutting down the furnace. These men are replacing a bad spot in the roof of a Noranda reverb with the magnesite blocks used there. Professor Hayward wonders if the benefits of indefintely prolonged life and increased furnace width of the Noranda system could also be secured with suspended silica-brick arches.

It would be a relatively simple matter to charge some pyrite on the slag near the skimming bay of the furnace, or even to treat it in a separate holding furnace, and if a cheap source of pyrite were available, the operation might prove economical.

Lead Slag Treatment

Fuming of lead and zinc from lead slags is becoming increasingly common, and old slag dumps where the zinc content is high are being reclaimed and treated at a substantial profit. At some plants the recovered fume is shipped to be treated at an electrolytic zinc plant. At others, fume is mixed with zinc-plant residues and refumed in a Waelz kiln. The product from this operation is carefully refumed to obtain a lead pigment and a zinc oxide that goes to a zinc retort furnace.

Sintering Practice

The tendency in new D. & L. installations is definitely toward larger, particularly wider, machines, and toward production of sintering machine gases suitable for acid or liquid SO_2 manufacture. A. S. & R. metallurgists can now produce such gases containing up to 6% SO_2.

Catching Waste Heat

Several plants are installing new waste-heat boilers in their copper reverberatory plants. Increase in capacity made recently in many reverberatory furnaces normally results in larger volume of gases, frequently at higher temperatures. Corresponding improvements have been made both in boiler design and arrangement.

Difficulties resulting from the settling of furnace dust on boiler tubes are well known. If the temperature is not excessive, the loose dust is frequently blown out, but in the meantime it tends to insulate the tubes and lowers heat efficiency. The greatest difficulty comes, however, when excessive heat causes sintering of the dust. At one plant a dust settling and cooling chamber has been provided between the furnace and the boilers.

Electric Copper Furnaces

The successful use over a period of several years of Heroult-type electric furnaces for copper refining at International Nickel Co.'s plant at Copper Cliff, Ont., should raise questions regarding the continued use of present standard refining practice in a period of rising labor and fuel costs. At this plant the cathodes are continuously charged

into a molten bath of copper and a continuous stream of molten copper flows out of the furnace to the casting equipment. The usual intermittent melting, oxidizing, and poling operations are thus avoided. In spite of the fact that electric furnace melting cost is normally much higher than melting in fuel-fired furnaces, it would seem that careful conservation of heat might make this competitive with usual operations.

It is possible that an induction furnace of the type used in making the OFHC brand of copper could be adapted to general copper refining with advantageous results.

Oxygen-Free Copper

The demand for oxygen-free copper has been gradually increasing, but it is still a minor factor in the copper industry. As demand increases, it should be possible to make savings that would allow a cut in the present premium required for the oxygen-free material.

It is reported that the leading copper plant in Finland has installed an induction furnace similar to that used at the OFHC plant at Carteret, N. J., and is highly pleased with the results. (See *E.&M.J.*, Jan. 1947, p. 72).

Other Electric Furnaces

Older metallurgists can well remember the revolution in the brass industry when the Ajax-Wyatt induction furnace replaced the old method of making brass in graphite crucibles. The industry has slowly stepped up its scale of operations since that time, but on the whole it has been rather timid in going to developments that would make use of really large furnaces.

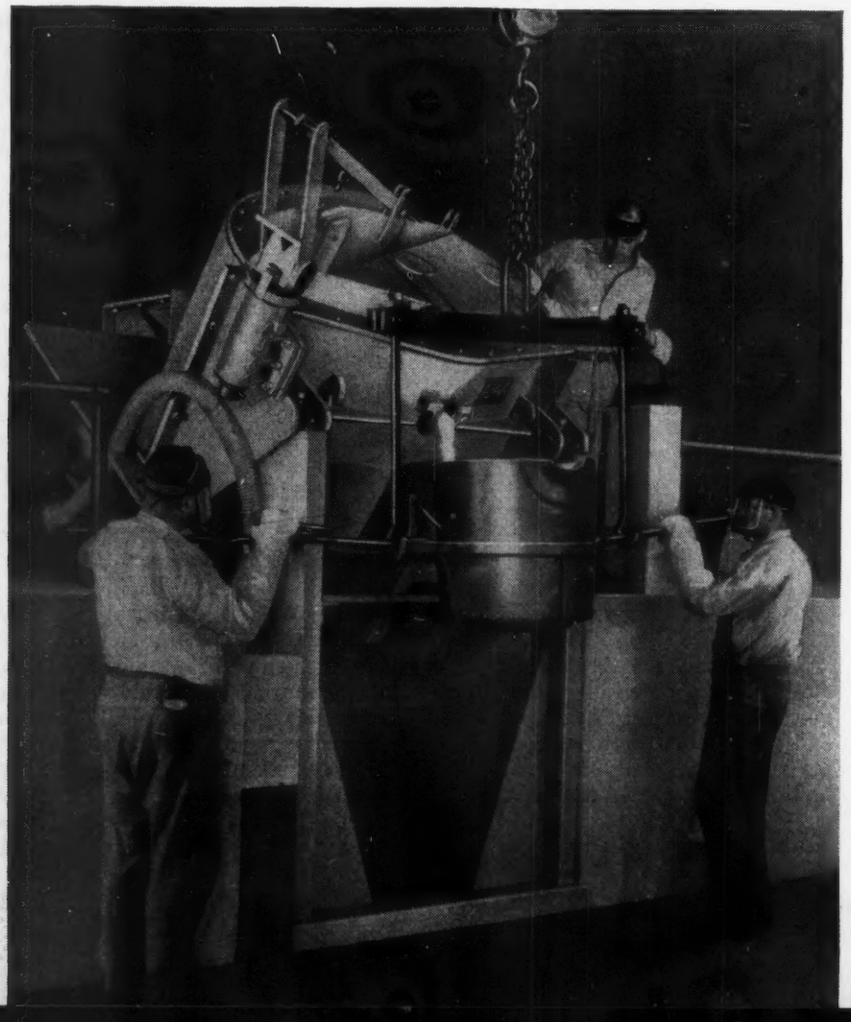
The induction furnace developed by D. L. Summey in the initial stages of the OFHC process was based on the Ajax-Wyatt principle but was a radical departure in size and gave some difficulties in operation. The present furnace used at the OFHC plant is a great improvement over the Summey furnace. In particular it has transformer units which are easily removed and replaced, thus minimizing time lost in shutdowns. This furnace can be made in various sizes and is being suggested for large-scale brass melting as well as for copper melting.

Manuel Tama, of Ajax Engineering Corporation, who collaborated with the Scomet Co. in developing its recent improvements in copper and brass smelting furnaces, has developed for the Ajax company, a low-frequency induction furnace for melting aluminum and aluminum alloys. Because of the ease with which aluminum and its alloys oxidize, a considerable occlusion of oxides and non-metallic particles in general occurs during the melting of ingots and scrap. Due to the low specific gravity of the metal, the particles are slow in rising to the surface and tend to clog the channels of the normal Ajax-Wyatt furnace. Tama has modified the furnace in such a way that the heating channels are vertical with a horizontal connection at the bottom. By use of a suitable tool the walls of the channel can be readily freed from adhering oxides or slag. The furnaces developed at Scomet and Ajax are thermostatically controlled so as to maintain a constant bath temperature during charging and casting.

A large furnace for melting electrolytic zinc cathodes and casting the product has been developed by a combination of the Scomet and Tama principles.

Continuous smelting and casting using low-frequency electric furnaces with automatic temperature control is being used in refineries where the product is bars or other shapes for further fabrication, in foundries producing various nonferrous castings, and in die-casting plants where large output demands a continuous supply of material.

OXYGEN-FREE COPPER is being produced in induction furnaces of the general type of the 125-kw. low-frequency furnace shown below, which is built by Ajax Engineering Corporation. This particular furnace is melting aluminum alloy chips, and it has been modified somewhat for this work. Continuous casting of copper is practiced at Copper Cliff in an electric furnace of the Heroult type.



Nickel

It is a well-known fact that nickel is not readily slagged in the open-hearth process for making steel, and that metallic iron will reduce nickel oxide found in the slag. A few years ago it was demonstrated that nickel could be added to open-hearth charges just as satisfactorily in the form of oxide as of metal and at less cost. To minimize dust losses, however, nickel oxide is now being furnished as sinter, which is readily taken up by open-hearth slags and then reduced by the iron.

MARKETS—Trends and Prices

JANUARY WITNESSED a continuation of the active buying movement in major non-ferrous metals that characterized operations in the last quarter of 1946. Though production is increasing, due to the recent rise in prices, consumers are not yet convinced that supplies eventually will be available in sufficient tonnages to meet the heavy demands of industry. In brief, a seller's market still exists in copper, lead, zinc, aluminum, and tin. The situation in regard to some of the minor metals was mixed. Weakness in foreign silver was pronounced, and quicksilver was unsettled. The drop in silver prices caused the E&MJ index of non-ferrous metal prices to decline from 142.19 in December to 140.88 in January.

Uncertainty over the availability of foreign copper without paying the 4c. import tax after Metals Reserve exhausts its supplies, which may occur before the end of March, made consumers anxious to accumulate additional supplies and injected further strength to an already strong situation. Scrap prices rose to above parity with primary copper. On Jan. 27 the American Smelting & Refining Co. advanced its price of copper in the domestic market to 20½c., Valley, or 1c. above the going market. Other sellers did not follow in this move and confusion over the market price was widespread. Consumption of copper during 1947 is expected to average between 110,000 and 120,000 tons a month. Unless domestic production of refined copper increases appreciably in the near future, fairly large imports will be necessary. So far, nothing has occurred that would indicate that anything will be done in Washington in the near future about the tariff. Our f.o.b. refinery differential has been increased to .275, owing to higher freight rates. The foreign price, f.a.s. New York equivalent, settled at 20.025c. per pound, against 19.875c. at the beginning of the month.

Lead advanced to 13c. per pound, New York, the highest price on record. Rising foreign prices and the tight

Major Metals

U. S. DAILY AND AVERAGE PRICES

1947 Jan.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: East St. Louis
1	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
2	19.225	19.800	70.000	12.550	12.350	10.500
3	19.225	19.800	70.000	12.550	12.350	10.500
4	19.225	19.675	70.000	12.550	12.350	10.500
6	19.225	19.800	70.000	12.550	12.350	10.500
7	19.225	19.800	70.000	13.000	12.800	10.500
8	19.225	19.800	70.000	13.000	12.800	10.500
9	19.225	19.925	70.000	13.000	12.800	10.500
10	19.225	19.725	70.000	13.000	12.800	10.500
11	19.225	19.800	70.000	13.000	12.800	10.500
13	19.225	19.925	70.000	13.000	12.800	10.500
14	19.225	19.925	70.000	13.000	12.800	10.500
15	19.225	19.925	70.000	13.000	12.800	10.500
16	19.225	20.025	70.000	13.000	12.800	10.500
17	19.225	20.000	70.000	13.000	12.800	10.500
18	19.225	19.925	70.000	13.000	12.800	10.500
20	19.225	19.925	70.000	13.000	12.800	10.500
21	19.225	20.025	70.000	13.000	12.800	10.500
22	19.225	19.925	70.000	13.000	12.800	10.500
23	19.225	20.125	70.000	13.000	12.800	10.500
24	19.225	20.100	70.000	13.000	12.800	10.500
25	19.225	19.925	70.000	13.000	12.800	10.500
27	19.575	20.125	70.000	13.000	12.800	10.500
28	19.425	20.100	70.000	13.000	12.800	10.500
29	19.500	19.925	70.000	13.000	12.800	10.500
30	19.350	20.025	70.000	13.000	12.800	10.500
31	19.450	20.025	70.000	13.000	12.800	10.500
AVERAGES FOR MONTH						
Jan.	19.270	19.926	70.000	12.931	12.731	10.500
AVERAGES FOR WEEK						
1	19.275	19.625	70.000	12.550	12.350	10.500
8	19.225	19.779	70.000	12.700	12.500	10.500
15	19.225	19.871	70.000	13.000	12.800	10.500
22	19.225	19.971	70.000	13.000	12.800	10.500
29	19.363	20.050	70.000	13.000	12.800	10.500
CALENDAR WEEK AVERAGES						
Jan.						
4	19.245	19.705	70.000	12.550	12.350	10.500
11	19.225	19.808	70.000	12.925	12.725	10.500
18	19.225	19.954	70.000	13.000	12.800	10.500
25	19.225	20.004	70.000	13.000	12.800	10.500

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.275c. per pound, the average differential for freight and delivery charges.

(b) Effective March 14, our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month; the premium on Special High Grade in most instances is 1¼c.

Quotations for lead are for common lead.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

1947 Jan.	Sterling Exchange "Checks"	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	Holiday	Holiday	Holiday	Holiday	Holiday
2	403.000	82.750	55½d.	172s. 3d.	$35.00
3	402.750	83.750	55½d.	172s. 3d.	35.00
4	403.000	(e)	(e)	(e)	35.00
6	403.000	82.750	55½d.	172s. 3d.	35.00
7	402.750	82.000	55½d.	172s. 3d.	35.00
8	403.000	82.000	55½d.	172s. 3d.	35.00
9	403.000	82.000	55½d.	172s. 3d.	35.00
10	403.000	82.000	55½d.	172s. 3d.	35.00
11	403.000	(e)	(e)	(e)	35.00
13	403.000	81.500	55½d.	172s. 3d.	35.00
14	402.750	81.500	55½d.	172s. 3d.	35.00
15	402.750	80.500	55½d.	172s. 3d.	35.00
16	403.000	78.750	55½d.	172s. 3d.	35.00
17	402.875	76.000	55½d.	172s. 3d.	35.00
18	402.875	(e)	(e)	(e)	35.00
20	402.750	70.750	55½d.	172s. 3d.	35.00
21	402.750	70.750	55½d.	172s. 3d.	35.00
22	402.875	70.750	55½d.	172s. 3d.	35.00
23	402.750	70.750	55½d.	172s. 3d.	35.00
24	402.875	70.750	55½d.	172s. 3d.	35.00
25	402.875	(e)	(e)	(e)	35.00
27	402.875	70.750	55½d.	172s. 3d.	35.00
28	402.875	70.750	55½d.	172s. 3d.	35.00
29	402.750	70.750	55½d.	172s. 3d.	35.00
30	402.750	70.750	55½d.	172s. 3d.	35.00
31	402.750	70.750	55½d.	172s. 3d.	35.00
AVERAGES FOR MONTH					
Jan.	402.870	76.500	55½d.	—	35.00
AVERAGES FOR WEEK					
1	402.750	83.750	—	—	—
8	402.917	82.650	—	—	—
15	402.917	81.500	—	—	—
22	402.854	73.400	—	—	—
29	402.833	70.750	—	—	—

Calendar week averages, New York Silver: **Jan. 4th, 83.500; 11th, 82.150; 18th, 79.650; 25th, 70.750.**

(e) Not quoted (Saturday).

(c) Determined by Handy & Harman on the basis of market prices for bar silver, in cents per troy ounce .999 fine, in amounts of 50,000 oz. or more, nearby delivery, New York. Price quoted is in cents and one-eighth cent fractions, and is usually about one-quarter cent below the market to allow for delivery, carrying, and marketing. In addition to foreign silver, the quotation also applies to domestic and Treasury silver if such silver enters into the market. The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS—Trends and Prices

supply situation here brought on the advance. Foreign lead was priced nominally at 11½c., Gulf ports. Transportation difficulties restricted the movement of the metal in Mexico and in this country.

Zinc was firm, but no attempt was made to raise the price. Demand centered chiefly in Prime Western and Special High Grade.

Consumers of silver, worried over inventories and high costs, purchased the metal on a greatly reduced scale. The prices suffered another sharp setback, falling to 70⅜c., New York. Offerings were not heavy, but sufficient in volume to unsettle the price structure.

Quicksilver was available in quantity from foreign sources, unsettling prices. The U.S. Commercial Co. offered 2,900 flasks brought here from Japan. Large supplies have been uncovered in Germany.

Miscellaneous Metals

(Monthly Averages)

Average prices of miscellaneous metals for December and January:

	Dec.	Jan.
Quicksilver, N. Y. flash....	88.120	88.000
Antimony (a)	27.155	29.591
Antimony, bulk, Laredo...	25.780	28.250
Antimony, in cases, Laredo	26.580	28.625
Antimony, Chinese (b)....	Nom'l	Nom'l
Platinum, oz. troy.....	62.280	57.038
Cadmium (c)	150.000	150.000
Cadmium (d)	152.500	152.500
Cadmium (e)	155.000	155.000
Aluminum ingot	15.000	15.000
Magnesium	20.500	20.500

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

Official London Prices

Since Dec. 18, 1939, the British Ministry of Supply has named maximum delivered prices for the major nonferrous metals. Prevailing prices for consumers in the United Kingdom, effective Jan. 1, 1947, follow:

	Per Long Ton		
COPPER:	£	s.	d.
Electrolytic, high conductivity...	117	0	0
Fire refined, high conductivity...	117	0	0
Fire refined, high grade.....	116	10	0
Fire refined, min. 99.7 percent...	116	0	0
Fire refined, min. 99.2 percent...	115	10	0
Hot rolled black wire rods.....	122	0	0
LEAD:			
Soft, foreign, duty paid.....	70	0	0
Soft, Empire	70	0	0
English refined	71	10	0
ZINC:			
Foreign (G.o.b.), duty paid.....	70	0	0
Domestic (G.o.b.)	70	0	0
Prime Western and debased.....	70	0	0
Refined and electrolytic.....	70	15	0
Minimum 99.99 percent.....	72	5	0
TIN:			
Ingot, 99 percent.....	380	10	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

MISCELLANEOUS METALS

(January 31, 1946)

Aluminum, ingot, 99 plus percent, lb.	15c.
Antimony, domestic, spot, lb., 5 tons or more, in cases....	29.562c.
Bismuth, ton lots, lb.	$1.80
Cadmium, commercial sticks, lb.	$1.50
Calcium, lb. ton lots, 97 @ 98 percent, cast	$1.85
Chromium, 97 percent grade, lb.	89c.
Cobalt, 97 to 99 percent, per lb.	$1.50
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 percent, carloads, lb.	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$58.00
Quicksilver, flask of 76 lb., 25 flasks or more	$88.00
Selenium, 99.5 percent, lb.	$1.75
Silicon, minimum 97 percent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$20.00
Titanium, 96 to 98 percent, lb.	$5.00

METALLIC ORES

Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit.	$10.00@$12.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio (Prices nominal)	$36.00@$37.00
48% Cr_2O_3, 3 to 1 ratio.	$38.00@$39.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.45
Mesabi bessemer	$5.20
Old Range non-bessemer	$5.30
Mesabi, non-bessemer	$5.05
Lead (Galena) 80 percent, Joplin, Mo., ton.	$166.85
Manganese, Metals Reserve Co. sales price, per long-ton unit of Mn contained, 48 percent, subject to premiums and penalties, effective May 15, 1944: 85c. (duty paid) New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c., Fontana, Calif., Provo, Utah, and Pueblo, Colo. (Current prices in open market nominal at 70@71c. per long-ton unit.)	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines.	45c.
Tungsten Ore, per unit of WO_3:	
Foreign, 60 percent, duty paid.	$22.00
Domestic, scheelite, 60 percent and upward.	$24.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines.	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$64.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl., carload lots	6c.
Cobalt Oxide, 70 to 71 percent, lb.	$1.06
Copper Sulphate, 100 lb.	$7.10

ALLOYS

Beryllium Copper, 2.5 to 3 percent Be, per lb. of contained Be	$14.75
Ferrochrome, 65 to 70 percent, per lb. of Cr contained.	15.60c.
Ferromanganese, 78 to 82 percent, gross ton.	$135.00
Ferromolybednum, 55 to 65 percent Mo, lb. of Mo contained	95c.
Ferrosilicon, 50 percent, per lb. of contained Si.	7.45c.
Ferrotungsten, 75 to 80 percent, lb. of W contained.	$1.90
Ferrovanadium, per lb. of V delivered.	$2.70@$2.90
Silicomanganese, 1 percent C, gross ton.	$138.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U.S funds), ton:	
Crude No. 1	$650@$758
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton.	$8.50@$9.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton.	$8.25@$8.50
Bauxite, long ton:	
Domestic, crude, 50 to 52 percent (not dried).	$5.00
Domestic, chemical, 55 to 58 percent.	$7.50@$8.50
Domestic, abrasive, 80 to 84 percent.	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk.	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh.	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 60 percent, all rail movement, ton.	$30.00
Acid 98 and 1 percent, bulk, ton.	$37.00
Fuller's earth, f.o.b. Georgia or Florida, ton.	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington.	$22.00
Mica: Domestic producers quote on punch and sheet as follows: Punch, 22c. per pound; 1½x2 inch, $1.10; 2x2 inch, $1.60; 2x3 inch, $2.10; 3x3 inch, $2.75; 3x4 inch, $3.50; 3x5 inch, $4; 4x6 inch, $5. Wet ground, very fine, $90 per ton. Special grades command premium. Bulk sales dry ground, $32.50 per ton. Scrap, $28 per ton and up.	
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c i f. Atlantic ports	12c. nom.
Silica, in bags, 325 mesh, ton.	$20.00@$40.00
Sulphur, Texas, mines, long ton.	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh.	$12.00@$15.00
Vermont, extra white, 200 mesh.	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored.	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic.	$28.00
Steel, base price, Pittsburgh Billets, gross ton.	$39.00
Structural shapes, 100 lb.	$2.35

WASHINGTON REFLECTIONS

McGRAW-HILL WASHINGTON NEWS BUREAU

Premium Plan Reorganized And Royalties Limited

The Premium Price Plan for copper, lead, and zinc, formerly administered jointly by OPA and CPA, has been consolidated under the Office of War Mobilization and Reconversion. The plan's new name is the Office of Premium Price Plan. The consolidation became effective Jan. 27.

Under the new set-up Harold Stein, commissioner for OWMR, is the final authority for payments and operations. Clarence O. Mittendorf, former OPA representative on the quota committee, is director of the new office. The personnel of the plan will remain, although some jobs will be redefined, Mittendorf said.

The premium review board set up under the new organization will consist of F. H. Hayes, director of metals and minerals division, CPA, chairman of the board; Jesse C. Johnson, deputy director of metals for RFC; and a representative of OPA, not yet appointed. The duties of the board are to consider and determine action on assignment and revision of quotas recommended by the director, and to consider and determine questions of policy, subject to the approval of the commissioner for OWMR. The board will also pass on appeals arising in operation of the plan, which may be taken to the commissioner, whose decision will be final.

Under the revised regulations, the Office of the Premium Price Plan will not approve a royalty rate for any operation which exceeds the one which prevailed on Nov. 10, 1946, when Maximum Price Regulation 356 governing royalty rates was revoked.

The new regulation stipulates that for all mines except those in the Tri-State area any royalty shall be accepted as a reasonable cost for purposes of premium payments; provided, that the rate stipulated is no greater than that which prevailed on Nov. 10, 1946, and the royalty is calculated on the sum of the market price plus assigned premiums, but not to exceed a total for both of 11c. a pound for zinc, 9¼c. a pound for lead, and 17c. per pound for copper, or on the market price for each of these metals, whichever is higher. For mines in the Tri-State area, any royalty shall be accepted as a reasonable cost provided that the rate is no greater than that prevailing on Nov. 10 and is calculated, in the case of zinc, on no more than the Joplin price of 60% zinc concentrates plus premium payments, but not to exceed a total for both of $79.70 per ton, and in the case of lead no more than the Joplin price of 80% lead concentrates plus premium payments, but not to exceed a total for both of $118 per ton; otherwise on the Joplin market price for zinc and lead concentrates, whichever is higher.

Where no royalty rate was established on Nov. 10, 1946, for a particular operation, the general level of rates for comparable operations in the same area shall determine the maximum rate acceptable as reasonable for purposes of premium payments.

Testimony Heard Over Proposed Tariff Cuts

Spokesmen for domestic metals producers have presented their arguments against possible tariff concessions to be proposed by the United States to 17 other nations. The Committee for Reciprocity Information heard arguments on both sides of the question in Washington from Jan. 16 through Jan. 20.

John A. Church, representing 16 domestic copper producers, argued that European countries lack financial resources to absorb a rising volume of African and South American copper. This default might cause a flood of copper into this country if tariffs were lowered. Early expansion of large-scale African production hangs over the world market at a time when American output has been brought to a fairly stable figure, he said.

Sam H. Morris, chairman of the Arizona Copper Tariff Board, stated that the present 4c. excise tax on copper imports is justified and that a cut would mean larger imports and lower prices. A going and healthy domestic copper industry is important to national security. The ability of the copper mines to respond to the nation's call for metal during the war was possible only because of the protection which the industry had had since 1932, he explained.

The zinc industry was represented by Ernest V. Gent, of the American Zinc Institute, and Otto Herres, of the Combined Metals Reduction Co., both of whom argued against any reduction in the tariff. Both pointed out that the 1938 reciprocity negotiation cuts in the tariff had injured the industry and urged that the 1930 rates be restored.

Norman Hickman, vice president of American Metal Co., urged lowering or removal of the tariff on zinc ores. [There is no statutory provision for reduction exceeding 50%.] He contended that the figures show that this country's production of slab zinc from domestic mines will have to be substantially augmented by imports, both in the form of metal and concentrates, and that there is no need for a continuation of tariff protection.

Some differential between metal and concentrate tariffs should be maintained, "which is not the case under the present tariff," Hickman said. The present rate structure tends to favor importing slab zinc rather than ore. Under present differentials, a zinc smelter must obtain a metal recovery of 85.71% from the concentrates treated in order to compete with the importer of slab zinc. He urged that a similar differential to that which exists between lead concentrates and metal be applied to zinc, pointing out that in lead the basic idea of assessing a higher duty on a finished product to protect American treatment of the imported raw material is quite evident.

Although metallic lead was not on the agenda for discussion, Dr. Graham Edgar, vice president of the Ethyl Corporation, recommended that lead be added to the commodities subject to reciprocity negotiations. Under present conditions there is no logical reason for a tariff on lead, he said.

The American Iron and Steel Institute added its weight to those favoring reductions of tariffs by urging reductions on iron and steel scrap, nickel, zinc, lead, manganese, and tungsten, and freezing of the free list on iron ore, tin, and palm oil.

Discussion was also heard on magnesite, graphite, mica, limestone spalls, fluorspar, coal, manganese ore, nickel, antimony, aluminum, tungsten, barytes, and pigments.

Congress Is Wrestling With Portal-Pay Issue

In attempts to cope with the "portal-to-portal" issue, which has reached the proportion of a national emergency, the Senate and House are approaching the problem from different angles.

In the Senate the Capehart-Wiley bill, on which hearings were held in January, amends the Wage-Hour law by defining "work" as those activities paid for according to established custom at a given plant, or according to collective-bargaining agreements. This bill also provides that court action under the Act must be initiated within one year of the time the cause of action accrued; however, it affords a three-month period of grace in which to institute claims under the present law.

The Gwynne bill, in the House, also provides for a 90-day grace period. It fixes a one-year statute of limitations on wage claims, and protects employers against retroactive application of revised administrative rulings or judicial decisions.

(Wash. Refl. continued on p. 118)

Five Congressional Bills Are of Special Interest

The 80th Congress, in the few weeks it has been in session, has seen dozens of bills important to the mining industry pass to committees of both houses. Of all of the bills, the following five are of special interest to mining:

S.-138 is an amendment to the act relating to direct loans for industrial purposes by Federal Reserve banks, approved June 19, 1934. The proposed amendment reads "to aid the United States in its national economy or security, the RFC shall make such loans for the development of the mineral resources of the nation as it shall deem to be advantageous to or in furtherance of the national economy or security." Development, as outlined by the bill, includes making accessible, examining or developing mine, placer or quarry workings, mining, milling, smelting or otherwise treating ores, and quarrying and preparing quarry products for the markets. Total loans under the bill would be restricted to $25,000,000.

Second (H.R. 871) is the National Mineral Resources Development bill, (Russell bill) for continuation of the Premium Price Plan for copper, lead, and zinc, in a revised form, for at least five more years. Under this bill, the plan would be consolidated under a director appointed by the President, and made an office of the Department of the Interior. An assistant director would be appointed by the Secretary of the Interior.

The personnel, records, and functions of the Quota Committee would be transferred to the new agency at the discretion of the director.

The "development and conservation payments" would be based on the metal or mineral content of the ore, but not to exceed the highest price (including incentive payment) paid to any operators of mines, mills, or smelters during the years 1942 to 1946, unless in the opinion of the director special consideration is desirable for stimulation of a given operation.

Reconstruction Finance Corporation would take title to all metals, minerals, and ores resulting from the payments, placing them in the national (military) stockpile unless the President, on written request of the secretaries of Commerce and Interior, should declare a state of civil emergency with respect to the individual metal or mineral. In this case the products would be sold at the then current market price.

A similar bill (H.R. 972) introduced by Representative Allen, is principally different in providing for the production to flow to market, instead of to the Government stockpile, unless the President orders otherwise.

Third on the list is the Geophysical and Geological Mining Claims bill, which would enable a prospector to locate a claim on lands belonging to the United States, prior to the discovery of a vein or lode or other mineral deposit within the limits of the claim. The prospector, within 90 days of filing location notice, would have to commence geophysical or geological prospecting according to good current practice.

If within two years the prospector discovers a vein, lode, or other mineral deposit, the claim becomes a valid unpatented one upon filing of an affidavit accompanied by adequate proof that such a deposit has been discovered.

Annual expenditure required to hold an unpatented geophysical or geological mining claim would be $100 for each 20 acres of its area, provided that the expenditure could be made at any one or more points within a group of contiguous claims if it would result in benefit to such claims as a group and if annual expenditures on the group aggregate $100 per claim.

Fourth of the mining bills slated for consideration (H.R. 1285) authorizes payment of compensation for furnishing or arranging to furnish strategic or critical minerals and metals for the prosecution of the war, a substitute for the contract termination proposals tabled by the last Congress.

The new bill provides for compensation for those who furnished or arranged to furnish, at a loss, strategic or critical minerals and metals for the war, without regard for any eligible or ineligible operation. The "eligible operation" is one of mining, milling, recovering, or concentrating, or preparing to mine, mill or concentrate, ores, from any source containing a mineral or metal declared by the Army and Navy Munitions Board to be strategic or critical from Sept. 8, 1939, to Dec. 31, 1945. The operation could have been with or without a contract, so long as it was started in good faith in response to an act of Congress or any encouragement from any Government official dealing in production, supply, and procurement of strategic metals and minerals for national defense, the war, or civilian supply.

Net loss would include only that sustained during the emergency and prior to Sept. 1, 1945, except that loss sustained in continuance of the operation for not more than six months in a "good-faith" attempt to lessen the loss, or in liquidating. Losses would include those on real or personal property, including leases, difference between the price paid for said property and the depreciated market value; a 4 percent per year return on capital invested; interest of not more than 4 percent per year paid or accrued on money borrowed for the operation; reasonable costs of corporate organization and financing; reasonable legal, engineering, and other professional services necessary to the operation; reasonable salaries or other compensation to claimants for services actually performed; and all other reasonable costs and expenses of the operation.

The payments under the bill would be made notwithstanding any exemption, contract, or termination settlement, award, or judgment, final or otherwise made under the Contract Settlement Act of 1944.

A War Minerals Claims division would be established in the Interior Department under a $12,000-a-year director appointed by the Interior Secretary. The amount of a net loss would be determined by an examiner appointed by the director. The examiner's findings could be reviewed by a panel composed of the director and two impartial examiners provided the claimant filed a written request for same within 30 days following the original determination.

The bill would not bar any Government agency or Congress from reinvestigating the claim and recovering any money in the payment of which the Government was defrauded. Any claimant would have the right to file a petition in the courts asking a determination by the courts of the equities involved, and the courts would have the power to determine the amounts to which claimants are entitled.

Fifth, Senator McCarran has indicated that he will reintroduce his bill to revise public land withdrawal procedure by requiring affirmative action of Congress before a withdrawal can be consummated.

Munitions Board Thinks Stockpile Funds Too Low

A great difference exists between what President Truman's budget message says will be spent on stockpiling next year and what the Army and Navy Munitions Board wants to spend. The mistake evidently started in the Budget Bureau.

The Board wants $360 million a year for the next four or five years for stockpiling, the total to amount to $1,800,000,000 and is going up to Congress soon to pound the table for what it considers its annual minimum.

The President's budget message says that $33,000,000 will be spent next year. The Budget Bureau got this figure by taking what was available for stockpiling, $100,000,000 appropriation by Congress last summer and a residue of $23,000,000 left over from wartime funds, and subtracting what the Board spent for stockpiling this year, about $90,000,000. With no new request for money from the Board, the Bureau figured that the remaining $33,000,000 would be spent next year.

Next year's figure if the Board succeeds in prying its full $360,000,000 out of Congress, will be close to $400,000,000, in addition to $210,000,000 worth of excess metals and materials left over in the RFC and CPA stockpile. RFC had estimated that some $87,000,000 worth of surplus stocks would be transferred in fiscal 1947 and about $210,000,000 worth in 1948.

NEWS OF THE INDUSTRY

Minnesota Section A.I.M.E. and University Symposium Draw Record Attendance

Papers presented on blast-hole diamond drilling, domestic ore reserves, beneficiation, and various concentrating devices

The annual meeting of the Minnesota Section of the A.I.M.E., and the annual technical symposium under the sponsorship of the University of Minnesota, held at Duluth Jan. 13, 14, and 15, was attended by an enthusiastic group of 325 to 350 registrants.

The A.I.M.E. session, which occupied the first day, began with a paper on "Diamond Drill Blast Hole Stoping at the Book Mine," by L. S. Chabot, Jr. Diamond drill blasting was adopted at this property because of a shortage of labor for ordinary sublevel stoping, and resulted in a production rate of 43 tons per man, counting driller, helper, and scraper operator. The average stoping cost is $4.75 per ton, including the same crew, or $1.83 per foot drilled. Kennametal bits in tests have drilled as much as 153 ft. per $12.50 bit, yielding a bit cost of 8c. per ton, or half the cost of diamond bits. The great flexibility of diamond drill blasting has made it possible to recover some otherwise unminable ore.

In the next paper, "The American Iron Ore Industry," Dr. Charles F. Park, Jr., presented general trends in the domestic industry, and recommended expanded domestic exploration, more imports, and utilization of low-grade materials. In the geological field he urged topographic and airborne magnetometer surveys of the whole Lake Superior region and modernization of U.S.G.S. Monograph 52.

The afternoon began with an exhibit of colored motion pictures of the Labrador iron developments, taken by Dr. A. K. Snelgrove, Michigan College of Mining and Technology. Later, the group visited the new research laboratory of Oliver Iron Mining Co.

Speaker at the evening dinner, which closed the A.I.M.E. session, was Evan Just, editor of *Engineering and Mining Journal*. Discussing "Problems Facing the Mining Industry," he stated that the domestic steel industry has an efficient capacity of 80,000,000 tons annually, but expects an average future demand of 50,000,000 to 60,000,000 tons. Pointing out that any comprehensive national security program would certainly take precautions to assure an adequate supply of iron ore or steel, he added that logical provisions for stockpiling should store manpower as well as resources; thus iron should be held in the form of pig and ingots or crude shapes of steel. Also, the Soo locks are too risky a bottleneck to make an iron-ore stockpile in the Lake Superior Region feasible. Thus, he urged that whatever portion of the efficient capacity of the country becomes idle in the next several years should be devoted to producing metal for stockpiling, until at least 100,000,000 tons has been accumulated.

The University-sponsored symposium on intermediate iron ore problems was opened with a discussion of "Lake Superior Iron Ore Reserves for the Future Operation of the U. S. Iron and Steel Industry," by G. W. Hewitt. (By intermediate ores is meant those of a quality lying between direct shipping ore and the taconites).

Taconites Stressed

In a presentation abundantly reinforced with tabulated statistics, Hewitt showed that on the average 66 tons of new ore has been added for every 100 tons shipped out of estimated reserves. He concluded that 36% over present listed taxable reserves is a reasonable estimate of the amount that will actually be shipped. This amount he estimates, as of the beginning of 1945, as 1,600,000,000 tons, or approximately a 25-year supply at an expectable rate of use. To supplement and husband this reserve, he suggests rapid development of the region's taconite resources.

The physical, rather than the economic, problems involved in treating the intermediate iron ores of the Mesabi were presented in a paper by Peter Warhol, A. E. Matson, and Louis J. Erck, all of Butler Brothers. The principal difficulty seems to lie in the wide variation in the nature of ores, not only as between different localities but in different beds in the same area.

W. L. Maxson and R. J. Morton gave a scholarly analysis of the theoretical side of gravity concentration, and J. Bruce Clemmer reviewed the work of the U. S. Bureau of Mines on flotation of iron ores. Clemmer favored use of caustic starch and lignin sulphonate as dispersants in order to float silica away from iron. He reports a probable reagent cost of 10.6c. per ton of crude in floating Birmingham ores.

It became apparent in discussion following Clemmer's paper that some disappointment prevails in flotation as a solution to the intermediate iron-ore problem. The principle objection that has been raised is one of cost rather than technique.

The second day of the University-sponsored session was given to discussions of new equipment for treating intermediate ores. The Dorrco Sizer, described by Roy Johnson, has gained wide favor, 26 machines now being used in 9 plants. Treating washer tailing, the Sizer has been able to increase weight recovery about 10% at a cost of 5c. per ton of concentrate. H. L. McNeill described the new Stearns-Roger selective media (Whizzer) concentrator, now used by Cleveland Cliffs and Oliver. Its work was reported by a spectator to be "almost perfect" in the size range of ¼ in. to about 48 mesh. The Humphreys spiral is being tested by Butler Brothers on washer tailing and seems to give good results at low cost, according to L. J. Erck and I. B. Humphreys.

Much interest was aroused by E. C. Bitzer's paper on new uses for the Akins type of equipment, both as a substitute for the cone in heavy-medium separation and as a substitute for a thickener in the medium-cleaning circuit. Harlowe Hardinge described a concentrator of the hindered-settling type that his company is now experimenting with, and W. L. Remick told of some interesting work with the Hydrotator, which has been modified to permit its use to concentrate iron ore. Byron Bird reviewed the work of the Jeffrey jig (Baum-type) in iron-ore concentration, but it was learned privately that even more interesting work is being done by an experimental jig that is under test by the company.

Airborne Magnetometer to Test Nickel Range

International Nickel Co. of Canada, Ltd., has engaged Aero Service Corporation, of Philadelphia, Pa., to conduct an airflown magnetic measuring survey of an area of about 1,000 sq.mi. in the Sudbury, Ont., nickel-mining district, according to an announcement from Ottawa. Aero Service Corporation, said to be the only company at present fully equipped for airborne magnetometer surveys, uses methods developed by the U. S. Geological Survey. These were described in the June 1946 issue of *E.&M.J.* A similar survey was recently flown in the Tri-State district.

O'okiep Acquires Former German Mine Properties

Acting as agent for interests composed of American Metal Co., Ltd., Newmont Mining Corporation, and several British and South African mining companies, O'okiep Copper Co., Ltd., has acquired the assets of Otavi Minen und Eisenbahn Gesellschaft, a German concern which was active in southwest Africa prior to the war. The news came in the form of an announcement by the O'okiep company that its bid of about £1,000,000 (South African currency) for the properties had been accepted by the Custodian of Enemy Property of the Union of South Africa.

The principal holding of the German company was the Tsumeb mine, some 350 miles inland from the seaport of Walvis Bay, on the South Atlantic. Pending rehabilitation of this mine, which has been under water since closing down in September 1940, it is planned to reclaim lead, zinc, and copper values contained in the surface dump.

A.I.M.E. Announces Anniversary Program

Many world-famed leaders of the mining industry will take part in the World Conference of Mineral Resources which is to be held in conjunction with the 75th Anniversary of the American Institute of Mining and Metallurgical Engineers at the Waldorf-Astoria Hotel, March 17 to 19 inclusive.

Louis S. Cates, president of the A.I.M.E., will preside at the opening luncheon on March 17, at which Cornelius F. Kelley, chairman of the board of the Anaconda Copper Mining Co., will speak on the achievements of the Institute.

Donald H. McLaughlin, president of Homestake Mining Co., will preside at the World Mineral Resources session. Speakers will include the Hon. Julius A. Krug, Secretary of the Interior; Clinton H. Crane, president of St. Joseph Lead Co.; and Charles M. White, president of Republic Steel Corporation.

Speakers at the World Mineral Economics session on March 18 will include P. M. Anderson, managing director of Union Corporation, Johannesburg, S. A.; the Hon. W. L. Clayton, Under Secretary of State; Pedro Beltran, former Peruvian Ambassador to U. S. A.; and C. Augustus Carlow, managing director of Fife Coal Co., Scotland.

Fred Searls, Jr., vice president of Newmont Mining Corporation, will preside at the Mineral Industry and Atomic Energy session. Speakers include Prof. George W. Bain, Amherst College; P. C. Leith, president of Hydrocarbon Research, Inc.; and Harry A. Winne, vice president of General Electric Co.

H. DeWitt Smith, engineer, Newmont Mining Corporation, is chairman of the session covering "Forecast of Mineral Technology." Robert E. Wilson, chairman of the board of Standard Oil Co. (Indiana); Zay Jeffries, vice president of General Electric Co.; and Louis S. Cates, president of Phelps Dodge Corporation, will speak at this session.

Clyde E. Williams, president-elect of the A.I.M.E., will preside at the general luncheon on March 19.

The Hon. Herbert Hoover, ex-President of the U. S. A.; the Hon. Spruille Braden, Assistant Secretary of State; and Virgil Jordan, president of the National Industrial Conference Board, will speak at the Anniversary Banquet on March 19.

Technical sessions usually held at the annual February meeting of the A.I.M.E. will begin on the afternoon of March 19 and conclude March 22.

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New Dredges to Restore Indies Tin Production

The first of eight $2,000,000 dredges on order for the Billiton Co., of The Hague, Holland, to be used in mining Netherlands East Indies tin deposits, was launched at Tampa, Fla., early in January. Christened the "Roosevelt," the new dredge has a hull length of 246 ft., with a width of 76 ft., and is capable of digging to a depth of 100 ft. below water level. It was designed by Bucyrus-Erie Co. and built by Tampa Shipbuilding Co. After fitting out it will be towed through the Panama Canal to Banka Island, chief tin-producing island in the East Indies.

Rehabilitation of properties damaged and looted during the Japanese occupation of the islands will require an expenditure of about $40,000,000 by the Billiton Co. and subsidiaries, it is estimated. In addition to new dredging equipment contracted for in the United States, some of the damaged dredges have been repaired and placed in operation. The Billiton company has made recent shipments of tin concentrates to the Longhorn smelter at Texas City, Tex.

Gift Will Aid Flotation Research at M. I. T.

A fund of $12,000 has been established by Armour & Co. for a graduate research program in the fundamentals of mineral flotation at Massachusetts Institute of Technology, Cambridge, Mass. The program will concentrate on the operation of cationic collectors, notably amines and amine salts, which give positively charged hydrocarbon-chained ions in water solution. Professor A. M. Gaudin, of the Department of Metallurgy, will direct the research work.

The current rate of depletion of high- and medium-grade mineral resources will impose upon the engineer of the near future the burden of obtaining metals, non-metallic minerals, and fuels from less favored raw materials, stated Professor Gaudin in announcing the Armour gift. Flotation has become the key process in mineral recovery from lean ores, and the research program seeks improved understanding of the fundamentals of the process and its more effective application to the mineral industry.

CIO's Southern Drive Loses Momentum

CIO's "Operation Dixie," its drive to organize workers in the South, has failed to be the whirlwind promised last May when the organizing committee set up headquarters in Atlanta. During the eight months of field work the CIO has won 304 elections and lost 59. However, only 57,179 employees took part in all the 363 elections held, of which 35,433, or 61 percent, voted for CIO unions. A tabulation of the voting shows that 13,691 voted against any union, 4,910 for AFL, 1,848 for District 50, AFL, and 1,297 voted for independent unions.

The International Union of Mine, Mill and Smelters Workers won 18 elections and lost one, with the voting going 1,395 for CIO, 78 against, 47 for AFL, and 29 for District 50, AFL.

Since the election of the Republican-controlled Congress, the Southern organizing committee has not pushed its drive for members as vigorously as in past months. Approximately 200 petitions are pending before the NLRB, and organizing strengths are centered around those plants at which elections are to be held.

Employer resistance to union organizing has increased recently. There also has been a growing resistance from workers. Any revision of the Wagner Act which would eliminate the closed shop, maintenance of membership, checkoff of dues, and give management equal rights with the unions in discussing issues with employees would seriously retard further unionization of Southern workers.

Technology Shares Spotlight With Labor and Economic Topics at C.I.M.M. Annual Meeting

Applications of the airborne magnetometer, geological characteristics of two well-known producing areas, investigation of long drift-round techniques, and progress of dust and silicosis control were among the many topics which held the attention of about 700 members and guests attending the annual convention of the Canadian Institute of Mining and Metallurgy Jan. 20 to 22 in Ottawa.

At the opening session R. J. Ennis, president of the Institute and general manager of McIntyre Porcupine Mines, Ltd., reviewed the status of mining and referred to the Dominion's second primary industry as a "war casualty," now operating under a "dense fog of uncertainty." He called for a more realistic policy of search to meet present and future mineral needs, citing the example of Russia, which is reported to have 10,000 geologists in the field. Describing the work of the Dominion Department of Labor, Arthur MacNamara, Deputy Minister, stated that young unemployed men in Nova Scotia, where a labor surplus exists, were being recruited for work in Ontario metal mines in numbers expected to be sufficient to overcome the shortage. He also said that the problem of immigration was receiving intensive study.

A preliminary report of Canada's 1946 mineral production was given by H. McLeod, of the Dominion Bureau of Statistics. The value of all minerals produced was $493.8 millions, $5 millions less than 1945. Value of metals dropped 9%, to $289.7 millions, lowest since 1936. Gold production gained slightly in quantity over 1945, but declined slightly in value because of the return to U. S. dollar parity.

Dr. George Shaw described surveys with the U. S. Geological Survey airborne magnetometer in Louvicourt Township, Quebec. This detector type of unit is suspended below a plane in such position as to be at right angles to the earth's magnetic field (*E.&M.J.*, June 1946). Dr. Hans Lundberg discussed the helicopter-borne magnetometer which he has developed. The use of a Bell helicopter makes it possible to fly surveys at altitudes as low as 150 ft., thus rendering practical the recording of vertical rather than total intensity, as in the case of the U.S.G.S. method. Costs of a helicopter survey are estimated to run about one-tenth the expense of a ground magnetometer survey. The minimum area for efficient mapping is a township, which can be covered in about four hours.

Recent developments in aluminum therapy were outlined in a paper presented by Dr. W. D. Robson and A. W. Jacob, of McIntyre Research, Ltd. Dr. Robson drew attention to a regrettable school of thought which is now asserting that aluminum therapy should be applied only to the relatively small percentage of miners who actually develop silicosis. This, he emphasized, runs contrary to the whole preventive purpose of aluminum therapy. Discussing the engineering phases, A. W. Jacob stated that 73 mines in Canada have now installed the change-house system of aluminum-powder ejection. An important new aid to operators is the filter-paper sampler, developed in cooperation with the U. S. Bureau of Mines, which employs the principle of differential light transmission through filter paper to determine the exact dust concentration in the place of application. It is planned to furnish samplers at cost to each licensee.

Research in the prevention of dust from pneumatic drills at Britannia Mining & Smelting Co. was described by R. J. Craig, assistant mine superintendent, and T. M. Waterland. It was found that a power-feed machine with a standard tappet-chuck, nonvented fronthead lowered the dust count to between 308 and 337 p.p.c.c.; water pressure was increased from 40 lb. to 80 lb. per sq. in. with material improvement.

Progress in underground air conditioning at Noranda Mines, Ltd., was described by C. T. Bischoff, chief mining engineer. The melting and freezing of ice in open stopes where mining is finished is used to produce warm air in winter and cool air in summer. Intake and exhaust raises, in combination with interconnected stopes at the deeper levels, serve to circulate the required air. Water sprays produce the ice. Establishment of a countercurrent flow of air and water is proposed as a further refinement of the method.

In a paper entitled "Investigation of Long Rounds in Development Headings," T. M. Gaetz, of the staff of International Nickel Co. of Canada, Ltd., described experiments with drift rounds designed to place the onus on the mucking rather than the drilling operation. One of the typical rounds tried in a 6x7 heading had two large-diameter holes in the center of the cut which were not loaded. The advance on 731 rounds in norite at the Murray mine averaged 9.43 ft. per round, or 1.85 ft. per labor-shift, including tramming. A later experiment, using a three-man crew to drill a 14-ft. round, with two large-diameter center holes, broke 12.38 ft. per round, but the advance per labor-shift was still low. Further experiments were conducted with a 6¾-in. center hole in a 9x10 heading, using diamond drills to put in 16-ft. long holes. Thus far, no way has been found of drilling the large-diameter holes economically, but efforts are being continued.

Observations on the performance of ⅞-in. and 1-in. quarter octagon drill steel with single-pass detachable bits were detailed by S. C. Yule, assistant mine superintendent, Kerr Addison Gold Mines, Ltd. The consistently high performance of the 1-in. shanks with ⅞-in. bits and either a 3-in. or 3½-in. machine in all types of ore has led to the adoption of this combination, with a 14% lowering of powder consumption in drifts.

Geological papers included a discussion of structural features at the Flin Flon mine by C. H. Stockwell, for the staff of Hudson Bay Mining & Smelting Co., and a description of the structural geology in the Cadwallader gold belt of the Bridge River district, B. C., by F. R. Joubin, of Pioneer Gold Mines, who illustrated the application of the strain ellipsoid to the vein pattern at the Pioneer and Bralorne mines. Frank Ebbutt, of Howe Sound Co., discussed and illustrated with slides the effect of minor structure on gold deposition.

At the final session Arthur Notman, consulting engineer, of New York, speaking on "The Future of Gold," advocated the restoration of free gold coinage in the United States as the first step toward reestablishing the confidence necessary to world trade.

The annual banquet heard an address by Viscount Alexander, Governor-General of Canada, who suggested coordination of the military services and equipment in peacetime in furthering aerial mapping, reconnaissance, and communications useful to the commercial development of the country.

Dr. Charles Camsell, former Deputy Minister of Mines and Resources, was elected president of the Institute for the coming year.

Oliver Iron Plans Large Outlay on Beneficiation

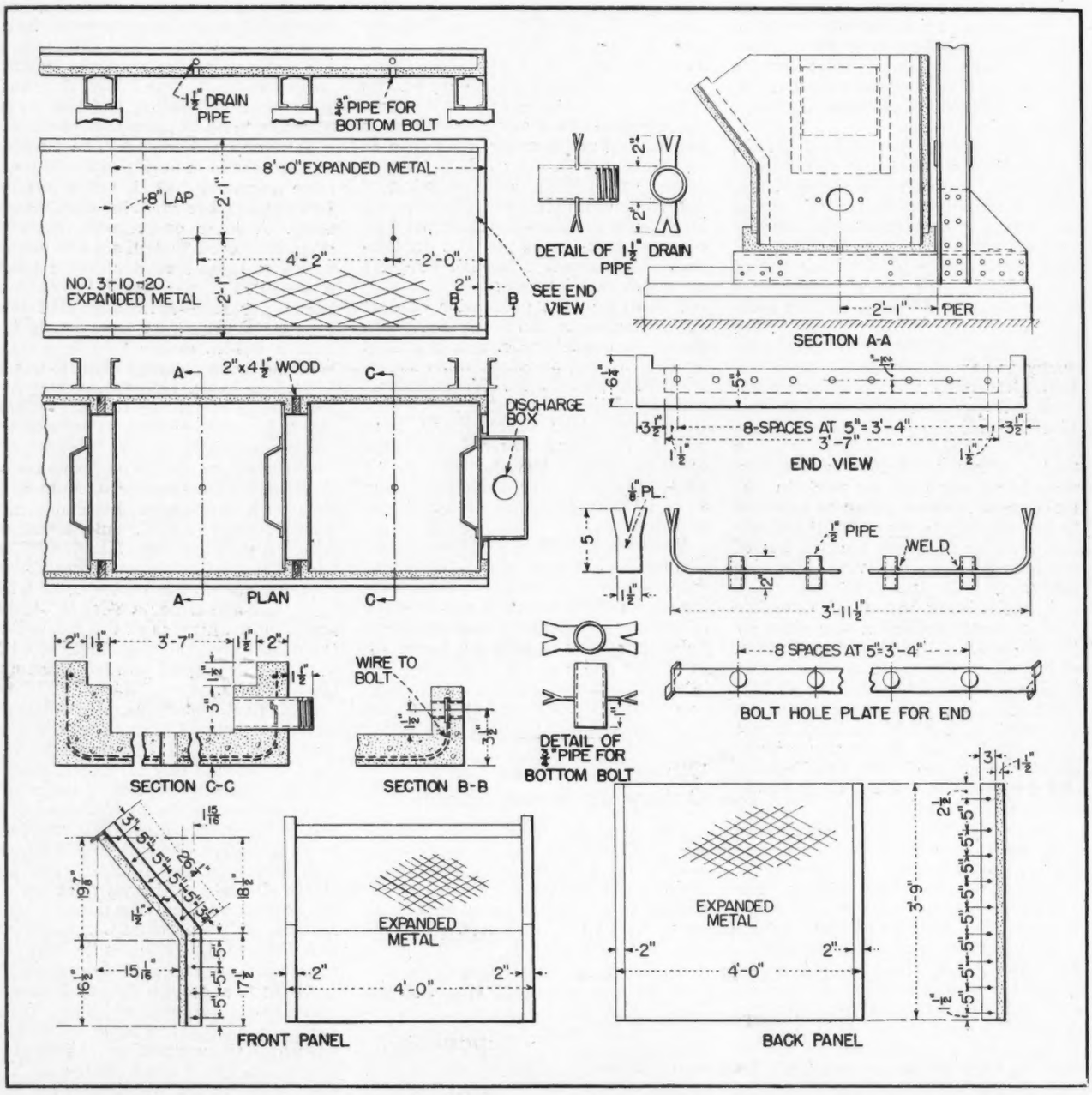
Two iron-ore beneficiation plants costing $2,000,000 will be erected this year as the first step in a long-range program of research expansion, according to an announcement on Jan. 21 by R. T. Elstad, president of Oliver Iron Mining Co., U. S. Steel Corporation subsidiary. The six-year program calls for four additional plants on the Mesabi Range and improvement of research facilities at the company's new Duluth laboratory. A total of $34,000,000 is to be expended in the field of beneficiation.

Utilization of marginal and high-silica ores and the reclamation of fine ores now lost in tailings are key objectives of the program. Extensive research on taconites will begin this year, following up work done in cooperation with Battelle Memorial Institute during the last three years.

The company also announced plans to invest more than $6,000,000 in developing underground properties. This amount is over and above the proposed expenditure on beneficiation.

OPERATING IDEAS

Concrete Flotation Cells Replace Wooden Ones



Concrete flotation cells were built to replace cells formerly constructed of British Columbia fir which had rotted out over a period of 15 years in the mill of McIntyre-Porcupine Mines, Ltd., Schumacher, Ont. Wartime scarcity of timber compelled the mechanical department to turn to some other material, and concrete proved to be the successful alternative. The cost of concrete cells is about the same as for wooden ones.

Essential construction details and dimensions are shown in the above illustration, where it will be noted that the sides and bottoms are adequately reinforced with expanded metal. The bottom of the cells is cast in place on the piers. Front and back panels are cast separately in forms before assembly. These panels fit into recesses in the bottom as shown in Section A-A'. A mixture of one part cement to 2½ parts gravel through ¼ mesh is used to construct the parts. Joints were sealed with Tremco caulking compound. Thereafter no leaks developed.

After having been in use for more than 16 months the cells do not show any appreciable signs of wear. The pulp circulated is of average abrasive quality, consisting of 6 to 8% sulphides and the remainder chiefly quartz.

SAFE POWER

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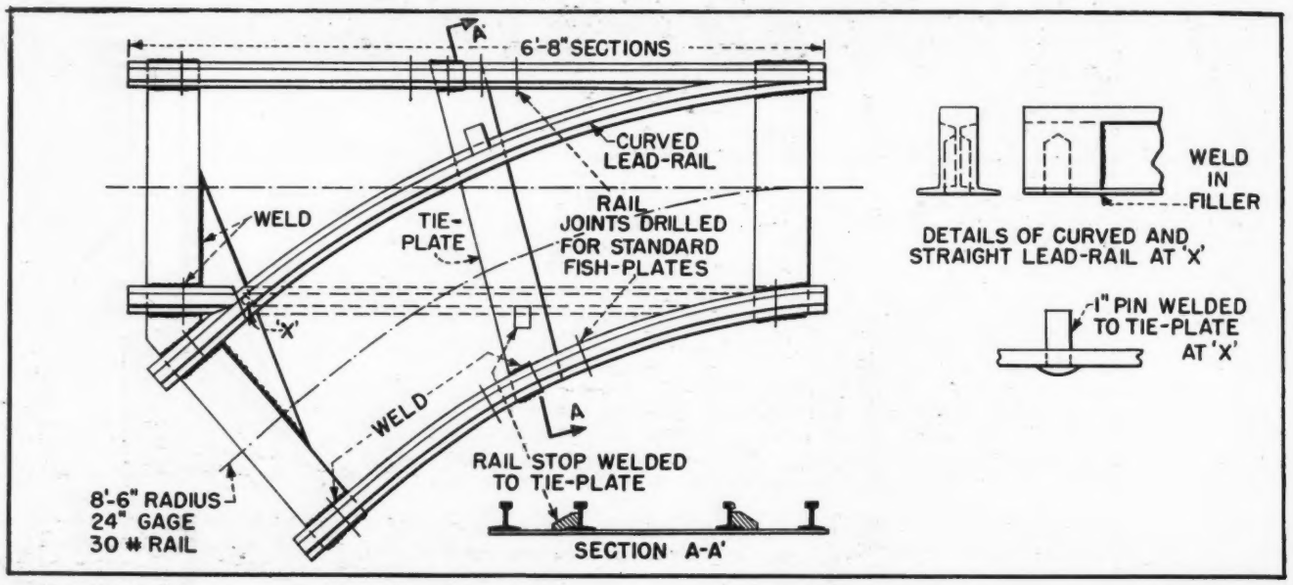
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

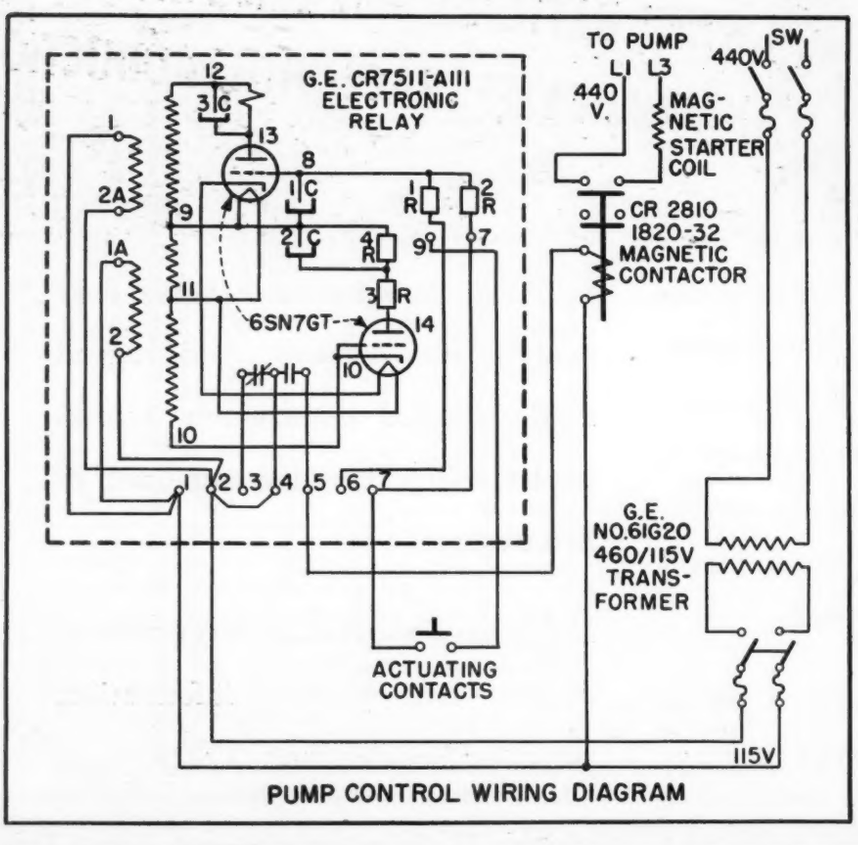
Light Track Switch for Stopes



Noranda Mines, Ltd., Noranda, Que., developed this standard-stope track switch for mucking machine and car in wide cut-and-fill stopes, according to C. W. Abrahamson, safety engineer.

As mechanical stope loading requires frequent shifting of tracks, the assembly is made light enough for two men to handle. Its dimensions are such that it can be transported through 4x4-ft. raises. The radius of curvature is short to enable the mucker to pick up ore with a minimum of mucking and cleaning. Outer straight rail and curved rail are cut in two, and frog ends of the rails are welded to the center tie plate as indicated. The joints are fastened together with standard fish plates. Straight and curved lead rails are readily interchangeable.

Sinking Pump Operated by Remote Control

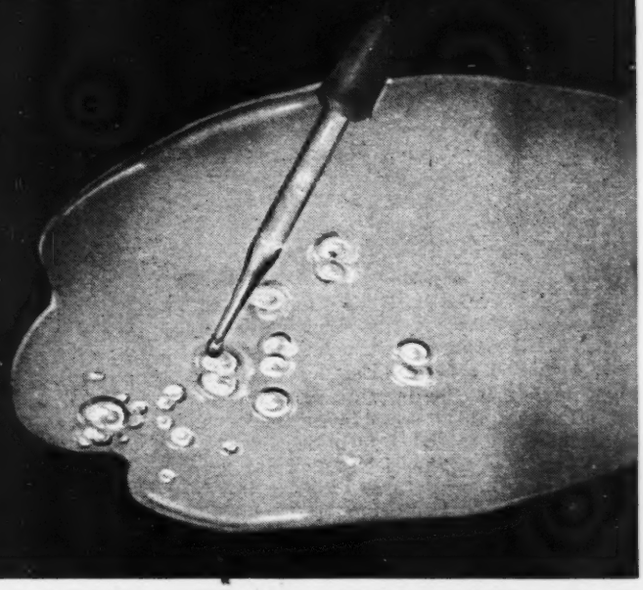


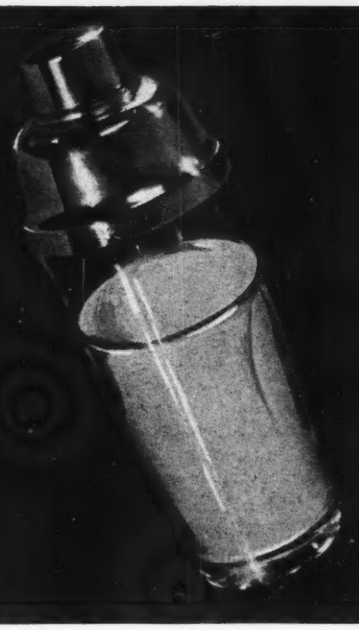
PUMP CONTROL WIRING DIAGRAM

Prior to the installation of this electronic pump control, which was evolved by Ned Allred, chief electrician, and Vernon Manz, general foreman, Eureka Corporation, Ltd., Eureka, Nev., and used successfully in the Fad shaft, the sinking pump was started and stopped by a conventional 440-v. control circuit. Line and starter switches had to be carried close to the pump, and pump men were exposed to the danger of shock when the control switches got wet. Switch equipment and lines were also exposed to damage by blasting. As a remedy, an electronic relay and a small magnetic contactor were installed, permitting the starting and stopping of the pump from the level above, or from some other point above the pump.

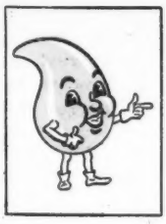
The general layout is shown in the accompanying wiring diagram. Contact between the electronic relay and the pump is made by a small two-conductor cable, which carries a voltage so low that bare contacts may be handled by the pump man without exposing him to the danger of shock.

FROM OILS THAT CAN'T "STAND" WATER





TO OILS THAT MIX WITH IT



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From his experience, the Shell Lubrication Engineer can help you when something's wrong and needs quick attention—and he can help prevent trouble by analyzing your equipment right now to see that you are getting the benefit of all that's new in lubrication.

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NEW BOOKS

The Iron-Ore Deposits of Mexico

ESTUDIO DE LOS YACIMIENTOS FERRIFEROS DE MEXICO. Luis Toron Villegas, Adrian Estevo Torres. Fasciculo II. Yacimientos del Grupo del Norte. Estados de Chihuahua, Coahuila, Durangó, Nuevo Leon y Zacatecas. Investigaciones Industriales del Banco de Mexico. (Study of the iron deposits of Mexico. Luis Toron Villegas and Adrian Esteve Torres. Fascicle II. Deposits of the Northern Group. States of Chihuahua, Coahuila, Durango, Nuevo Leon, and Zacatecas. Industrial Investigations of the Bank of Mexico. Pp. 147, 90 plates of maps and sections, 67 plates of photographs (219).

This work is one of a series of similar reports issued by the Bank of Mexico as a contribution to the industrialization of that country. The present volume, fascicle II, precedes fascicle I, not yet published. Fascicle I is intended to include a geological and tectonic panorama of Mexico, as well as descriptions of ferriferous zones not included in this volume.

State of Zacatecas: Concepcion del Oro. Four deposits are within 7 km. of this town: La Piedra Imán, La Carmen, Sol y Luna, and Animas de Cerro Prieto. They are of pyrometasomatic origin, lying in a granodiorite mass near its contact with limestone, and associated with corneous garnet. The ores are hematite with lesser quantities of magnetite. The ores of the Carmen are somewhat auriferous and have been sporadically exploited for their gold; those of the Animas de Cerro Prieto pass into auro-cupriferous iron ores; and of Sol y Luna are hematite at the surface, passing in depth into magnetite, heavily charged with pyrite. Ore reserves for the district are (1) measured, 1,054,800 tons; (2) probable, 2,949,300 tons; (3) possible, 1,134,900 tons. The grade ranges up to 68 percent Fe, with sulphur sometimes exceeding 2 percent, and phosphorus variable, up to 0.6 percent.

State of Coahuila: Cerro del Mercado. (Not the Cerro de Mercado of Durango.) These deposits are situated near Monclova, 2 km. from rail, in the Cerro del Mercado. This hill consists of Cretaceous limestone, with a central core of granodiorite. The deposits, of pyrometasomatic origin, form a discontinuous ring following the contact of the limestone and the intrusive rock, accompanied by marmorization and contact lime silicates. The important deposits are Vesper, La Gran Republica, Las Alazanes, and Excelsior. The ore is hematite with magnetite with tenors up to 67½ percent Fe, sulphur to 1.8 percent, and phosphorus to ½ percent. Ore reserves total 2,768,899 tons, including 1,952,472 tons measured, and 815,427 tons probable.

Chihuahua and Coahuila: Deposits about Camargo, Chih. There are three deposits lying from 120 km. to 160 km. east of Camargo, the nearest railroad point. These are La Perla, in the Cerro de Tacubaya; La Negra, in the Sierra de Encinillas; and Hercules, in the plain north and northeast of the Sierra de las Cruces. These unusual deposits are found in Tertiary rhyolite, forming irregular masses of massive hematite and magnetite or pulverulent hematite. They range up to 66 percent Fe, and are low in sulphur and phosphorus. Ore reserves are: (1) measured, 6,002,762 tons; (2) probable, 3,318,750 tons; and (3) possible, 2,313,000 tons, a total of 11,634,512 tons.

State of Durango: Cerro de Mercado. This important iron deposit, the largest producer in Mexico, is 3 km. north of the city of Durango. Cerro Mercado is a detached hill at the northwest edge of the valley of Guardiana. This hill is made up of latite, rhyolite tuffs, and breccias, porphyritic rhyolite, quartz porphyry, and a rock referred to as pyroxenite, and has a number of peaks and large outcrops of iron ore. These iron-ore bodies are aligned in three zones and result from the faulting of a large tabular mass of ore, which, however, has no continuity in depth. The ore consists of hematite, some of it in the pseudomorphous form, martite. Apatite occurs in pockets, as clear, yellow, well-formed crystals. The ores range up to 68 percent Fe, are low in sulphur, but high in phosphorus. Ore reserves are: (1) measured, 45,402,631 tons; and (2) probable, 10,704,780 tons, a total of 56,107,411 tons.

The authors' theory to account for this large and unusual occurrence of iron ore postulates a magma chamber underlying the region, from which the lava flows were extruded, with alternating explosive activity yielding tuffs and breccias. Contemporaneously or later, a second magma chamber of basic or intermediate composition existed in which differentiation through crystallization of iron oxides took place. These crystals accumulated in the lower zones, and were remelted and extravasated as a mass of iron ore, or injected as a laccolith between the lower rhyolite and upper latite. Later faulting has broken this sheet of iron ore into blocks.

State of Nuevo Leon: Golondrinas. These deposits are found in the Sierra de Carrizal, 133 km. north of Monterrey. A rail spur connects the district with the main railroad line, and the ores are shipped to Monterrey. An intrusion of granodiorite forms the core of an anticline in limestone. The ore deposits form a discontinuous zone of large pockets of ore along the contact of the two formations, associated with marmorized limestone and contact silicates. No estimate of ore reserves is given.

Rinconada. This deposit lies near the Monterrey-Saltillo highway, at Kilometer 29. The orebody is an almost vertical, tabular mass of ore in limestone. The ores are shipped to Monterrey. No estimate of ore reserves is given.

W. F. FOSHAG
Curator, Mineralogy and Petrology, U. S. National Museum

STANDARD PRACTICE FOR LOW AND MEDIUM SPEED STATIONARY DIESEL ENGINES. Published by Diesel Engine Manufacturers Association, 1 North LaSalle St., Chicago 2, Ill. Pp. 157. Price $2.50.

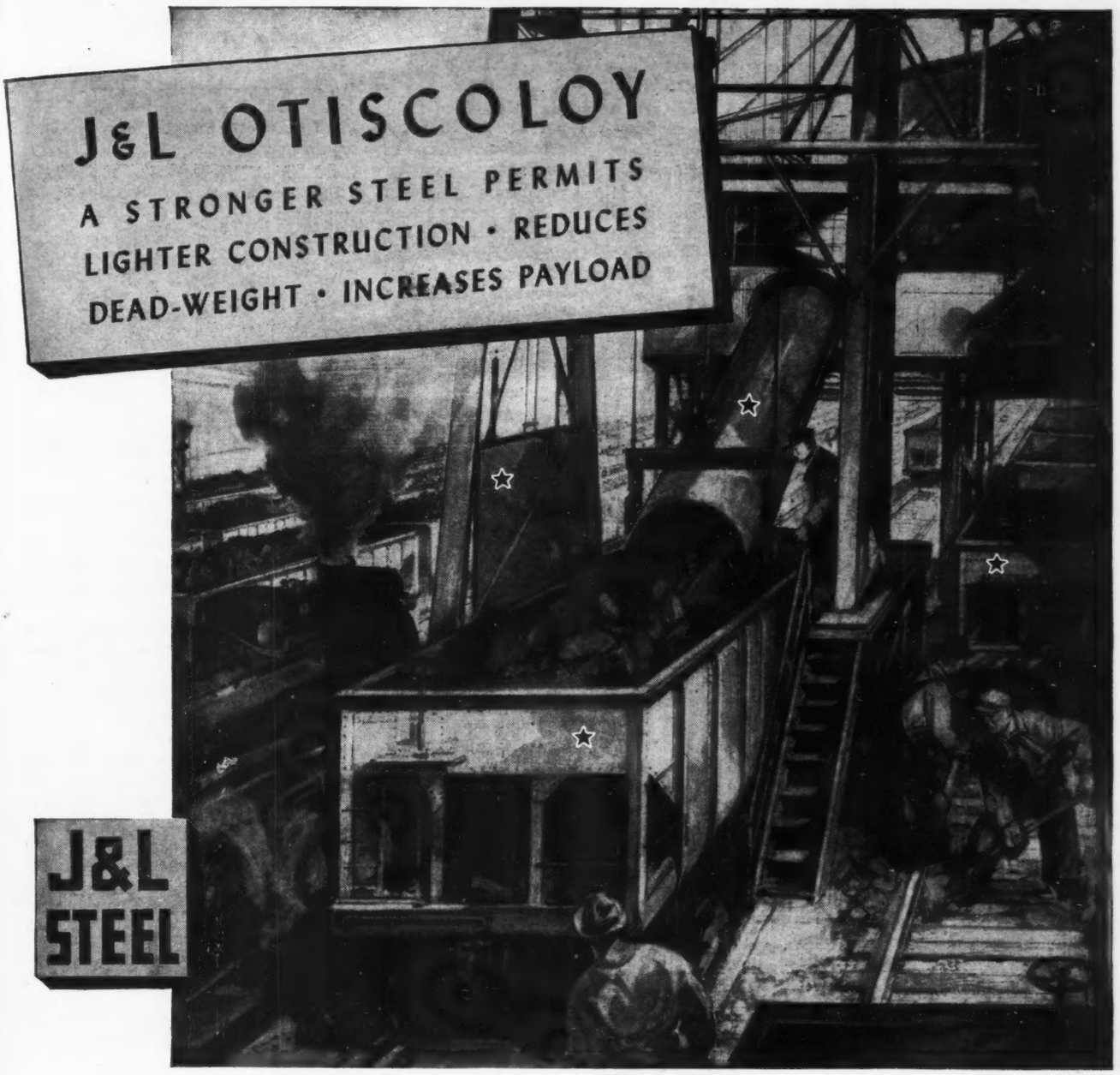
Published to be of service to diesel-engine users, prospective buyers, and consulting engineers, this text covers stationary diesel engines at speeds up to and including 750 rpm. Precise definitions of all terms relating to the construction and operation of diesel power plants, and thorough chapters on field test codes, and bids and specifications, are designed to promote a more intelligent agreement between seller and buyer of diesel equipment.

Elements of diesel plants including intake and exhaust systems, cooling water systems, lubricating-oil systems, electrical equipment, fuel storage and handling systems are discussed and illustrated. Other chapters cover design of diesel power plant buildings, lubricating-oil characteristics, fuel-oil characteristics, speed regulation, and diesel-engine construction.

PUBLICATIONS RECEIVED

Saudi Arabia. With an Account of the Developments of Its Natural Resources. By K. S. Twitchell. Princeton University Press, Princeton, N. J. Pages 192. A review will appear in an early issue. Price $2.50.

Oil for Victory. By the editors of "Look." This story of petroleum in



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war and peace is one of the Whittlesey House series, published by McGraw-Hill Book Co., Inc., 330 West 42d St., New York 18, N.Y. The book is largely pictorial. Pages 287. Price $3.50.

Examination of Industrial Measurements. By John W. Dudley, Jr. American Viscose Co. McGraw-Hill Book Co., Inc., 330 West 42d St., New York 18, N.Y. The book is intended to acquaint engineers with simple, adaptable statistical techniques for the detection of variation in industrial products. Pp. 113. Price $2.

Industrial Opportunities in the Cotton South. The first section consists of maps showing distribution of the following minerals: Bauxite and fluorspar; coal; diatomite and kaolin; dolomite and forsterite; fuller's earth; glass sand; iron ore; kyanite, sillimanite, and graphite; mica; native sulphur, pyrites, and phosphates; salt; talc, soapstone, pyrophyllite, and feldspar; tungsten, titanium, and manganese. Section 3 consists of maps showing the location of plants producing aluminum, alumina, and magnesium. Issued by Machinery and Metals Section, Industry Division, Office of Domestic Commerce, Department of Commerce, Washington, D. C.

"Geology of the San Juan Bautista Quadrangle California." By John Eliot Allen. Bulletin 133, State of California, Division of Mines, Ferry Building, San Francisco, Calif. Booklet also contains description of the operations of the Granite Rock Co. quarry and plant at Logan, San Benito County, Calif., by Royal E. Fowle. Text pages, 81, including maps, geologic plans and sections, and photographs on separate plates. Price $1.50 plus state sales tax.

California Journal of Mines and Geology. Vol. 42, No. 2, April 1946, Division of Mines, Ferry Building, San Francisco, Calif. Principal subjects are "Quicksilver Deposits of the New Idria District San Benito and Fresno counties, Calif.," by Edwin B. Eckel and W. B. Myers, geologists, U. S. Geological Survey, and "Quicksilver Deposits at the Sulphur Bank Mine Lake County, Calif.," by Donald L. Everhart, geologist, U. S. Geological Survey. Pp. 153. Price 60c., plus 2c. sales tax for purchasers from other states.

Pumice and Pumicite Occurrences of Washington. Report of Investigations No. 15, Division of Mines and Geology, Olympia, Wash. Pp. 78. Price 25¢.

Manitoba. Seventeenth Annual Report on Mines and Minerals for the Year Ended April 30, 1945. Mines Branch, Department of Mines and Natural Resources, Winnipeg, Man. Pp. 105.

Census of Western Australian Minerals. Bulletin No. 1. Department of Mines, Perth, Western Australia.

Tantalum and Niobium. Bull. No. 3, Department of Mines, Perth, Western Australia. Pp. 150, plus maps.

Western Australia. Report of Geological Survey for 1944. Pp. 56. Including folded illustrations.

Minerals Yearbook 1945. The U. S. Bureau of Mines has issued preprints of certain chapters of the 1945 edition of its Minerals Yearbook. These are to be obtained from the Superintendent of Documents, Washington 25, D. C. The topics treated include the following. (The price is given in each instance.) Foreign minerals review (15¢); the mineral industry of Alaska (5¢); bauxite (5¢); antimony (5¢); asphalt and related bitumens (5¢); clays (10¢); magnesium (5¢); lime (10¢); mica (10¢); minor non-metals (10¢); tin (10¢); zinc (10¢); aluminum (5¢); copper (10¢); gold and silver (10¢); gold, silver, copper, lead, and zinc in California (10¢); pig iron, ferro-alloys, and steel (10¢); iron and steel scrap (10¢); secondary metals, non-ferrous (10¢); iron ore (10¢); minor metals (10¢); statistical summary of mineral production (15¢).

The U. S. Bureau of Mines, Washington, D. C., has issued the following Information Circulars and Reports of Investigations (no charge is made. Address the Director):

I.C. 7365. "Description of Typical Mine-Telephone Systems and Suggestions for Making Improved Installations." Pp. 17.

I.C. 7381. "Metallic Titanium and Its Alloys." Pp. 38.

I.C. 7383. "Summarized Statistics of Production of Lead and Zinc in the Tri-State (Missouri-Kansas-Oklahoma) Mining District." Pp. 67.

R.I. 3912. "Exploration of the New Dale Rundell Zinc Mine, Mifflin District, Iowa County, Wis." Pp. 8.

R.I. 3913. "Exploration of Spirit Mountain Nickel Prospect, Canyon Creek, Lower Copper River Region, Alaska." Pp. 8.

R.I. 3931. "Pilot-Plant Production of Electrolytic Manganese From Manganese Ores From Metals Reserve Stock Piles at Deming, N. M., Cushman, Ark., and Phillipsburg, Mont." Pp. 19.

R.I. 3933. "Exploration of the Jewell Tunnel Zinc Property, Chaffee County, Colorado." Pp. 12.

R.I. 3944. "Exploration of Mountain View Tungsten Deposit, Hyder, Alaska." Pp. 10.

R.I. 3937. "Exploration of the Stoddard Fluorite Mine, Cheshire County, N. H." Pp. 6.

R.I. 3938. "Magnesia from Olivine." Pp. 33.

R.I. 3939. "Exploration of the Moffet-Johnson Copper Property, Madison County, Montana." Pp. 12.

R.I. 3940. "Exploration of Argentiferous Lead-Copper Deposits of the Slana District, Alaska." Pp. 9.

R.I. 3942. "Exploration of the Copper-Sulphur Deposit, Khayyam and Stumble-on Properties, Prince of Wales Island, Alaska." Pp. 8.

R.I. 3943. "Exploration for Fluorite, Crittenden and Livingston Counties, Kentucky." Pp. 44.

R.I. 3945. "Exploration of the Riley Tungsten Mine, Humboldt County, Nevada." Pp. 7.

R.I. 3946. "Exploration of Bishop Cap Fluorspar Project, Dona Ana County, N. M." Pp. 7.

R.I. 3947. "Exploration of the Gray and Bautsch Lead and Zinc Deposits, Jo Daviess County, Ill." Pp. 28.

R.I. 3948. "Exploration of the Defense Zinc Property, Iowa County, Wisconsin." Pp. 7.

R.I. 3950. "Exploration of a Nickel-Copper-Cobalt Deposit at Funter Bay, Admiralty Island, Alaska." Pp. 15.

R.I. "Exploration for Barite in Hot Springs County, Arkansas." Pp. 21.

R.I. 3952. "Exploration of the Jumbo Basin Iron Deposit, Prince of Wales Island, Southeastern Alaska." Pp. 9.

R.I. 3953. "Exploration for Fluorite, Krausse Estate Property, Crittenden County, Kentucky." Pp. 15.

R.I. 3954. "Exploration of the Crowell Flourspar Mine, Nye County, Nev." Pp. 9.

R.I. 3955. "Exploration of the Brown-Iron Ores, Churchwell and Robinette Tracts, Western Highland Rim District, Wayne County, Tenn." Pp. 18.

R.I. 3956. "Exploration of Poor Man Iron Deposit, Kasaan Peninsula, Prince of Wales Island, Southeastern Alaska." Pp. 8.

R.I. 3957. "Exploration of Chamberlain-Barnardville Iron Deposits, Roane County, Tenn." Pp. 19.

R.I. 3958. "Exploration of the Mohawk Zinc Prospect, Pima County, Ariz." Pp. 10.

R.I. 3960. "Exploration of Lookout Mountain and Sand Mountain Coal Deposits, Dade and Walker Counties, Ga." Pp. 10.

R.I. 3961. "Exploration of the Bourbon Magnetic Anomaly, Crawford County, Mo." Pp. 9.

R.I. 3962. "Exploration of Silver Eagle Zinc Deposit, Hudspeth County, Tex." Pp. 4.

R.I. 3964. "Exploration of the Brutch Sulphur Deposits, Hot Springs County, Wyo." Pp. 15.

R.I. 3965. "A Method for the Spectrochemical Determination of Germanium, Tin, and Lead in Ore Samples." P. 38.

R.I. 3966. "Inflammability of Gasoline Vapor-air Mixtures at Low Pressures." Pp. 5.

R.I. 3967. "Exploration of Sedanka Zinc Deposit, Sedanka Island, Alaska." Pp. 15.

R.I. 3968. "Exploration of Iron Mountain Titaniferous Magnetite Deposits, Albany County, Wyo." Pp. 37.

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PERSONAL NEWS

Wilson D. Mitchell, who for the past two years has been chief geologist for the Magma Copper Co., at Superior, Ariz., has left for Morocco, North Africa, where he will be engaged in mine examination work.

Stephen Bond recently accepted the post of manager for the Oxbow Silver Mining Co., Ltd., which is conducting explorations in South Lorrain Township, Ont.

John H. Hearding, Jr., has been appointed general superintendent of the Hibbing-Chisholm district of the Oliver Iron Mining Co. He succeeds **Albert St. Vincent,** who retired Jan. 1 after 48 years of service.

John Chisholm has been named assistant general superintendent of the Hibbing-Chisholm district, succeeding Mr. Hearding. Mr. Chisholm has been employed by the Oliver company since 1937.

Dr. Victor Dolmage has been engaged as consulting geologist by Dentonia Mines, Ltd., near Greenwood, B. C.

J. B. Williams has been engaged as mill superintendent by The Twin "J" Mines, Ltd., at Mt. Slicker, Vancouver Island. He was formerly in charge of the mill under the operation by Wartime Metals Corporation.

E. E. Mason, recently mine manager of Cariboo-Hudson (1946) Gold Mines, Ltd., and consulting engineer for several Cariboo, B. C., mining operations; has accepted the position of mine manager of Cochenour Willans Gold Mines, Ltd., at McKenzie Island, Ontario.

C. Rutherford left Vancouver for Casummit Lake, Ont., at the first of the year to make a professional inspection. He planned to continue as far as Ottawa to attend the annual meeting of the C.I.M.M. before returning to British Columbia.

Olin H. Horton, of 1259 Ninth St., Birminghm, Ala., has been named secretary of the Alabama Mining Institutue, succeeding **Clyde A. Pippin,** resigned.

Will Mitchell, a 1940 graduate of the Montana School of Mines and now engaged in atomic energy research work at M.I.T., Cambridge, Mass., recently inspected the laboratories of the Canadian Bureau of Mines at Ottawa; Oliver Iron Mining Co., at Duluth; and the Montana Bureau of Mines at Butte. He will inspect the research laboratories of the Battelle Institute at Columbus, Ohio.

Sidney M. Ward, of Clinton, Mont., president of the Western Montana Mine Owners and Operators Association, is spending the winter at 325 Pine Street, Helena, Mont. Mr. Ward is the owner of the Hidden Treasure mine, in Missoula County.

Roger Pierce, formerly with the Ingersoll-Rand Co. as field engineer and specialist on underground mechanization problems, has established a

ROGER PIERCE

private consulting office in Salt Lake City, Utah. He is also in charge of mining sales for the Cate Equipment Co., Salt Lake City, in which he has acquired an interest.

F. A. Roberg has left Australia to take up an appointment as field engineer on rehabilitation of tin dredges of the Kuala Lumpur and Tongkah Compound groups in Malaya.

J. H. Tyrrell has been appointed superintendent of the mining areas of Hampton Gold Mining Areas Ltd., in Western Australia. Mr. Tyrrell was associated with Gold Fields Australian Development Co. and was manager of that company's Moonlight Wiluna Gold Mine at Wiluna.

Oscar W. Jarrell left New York in January for a minimum of six months assignment as geologist for the Cyprus Mines Corporation. The last three years he has had headquarters in New York as assistant to the project manager of Union Mines Development Corporation.

Clinton H. Crane has announced his retirement as president of St. Joseph Lead Co. Mr. Crane has reached the age of 74 and has been head of the company since 1913. He will be succeeded by **Andrew Fletcher,** vice president and treasurer of the company for the last 17 years. Mr. Fletcher is also treasurer of the A.I.M.E.

Charles Camsell, Deputy Minister of the Department of Mines and Resources at Ottawa, has been elected an honorary member of the Canadian Institute of Mining and Metallurgy.

W. J. Nichols, who was an officer of the Royal Canadian Engineers during the war, and formerly superintendent for Slate Bay Gold Mines, Ltd., has joined the faculty of the Department of Mining at the University of Toronto.

Lawrence A. Roe, formerly research engineer in the Materials Beneficiation Division of Battelle Memorial Institutue, is now research engineer for Jones & Laughlin Steel Corporation at Star Lake, N. Y.

R. F. Mahoney has been elected vice president and director of Callahan Zinc-Lead Co. Mr. Mahoney, who leaves Sunshine Mining company as general superintendent, has been with that company for the past 12 years. He will assume direction of operations, development programs and exploration activities of Callahan Zinc-Lead Co.

G. A. Joslin, consulting mining engineer, Los Angeles, Calif., has been appointed manager of Towne Securities Corporation, of New York, with headquarters in Mexico City, Mexico. Mr. Joslin until his present appointment served as chairman of the Mining Committee, Los Angeles Chamber of Commerce.

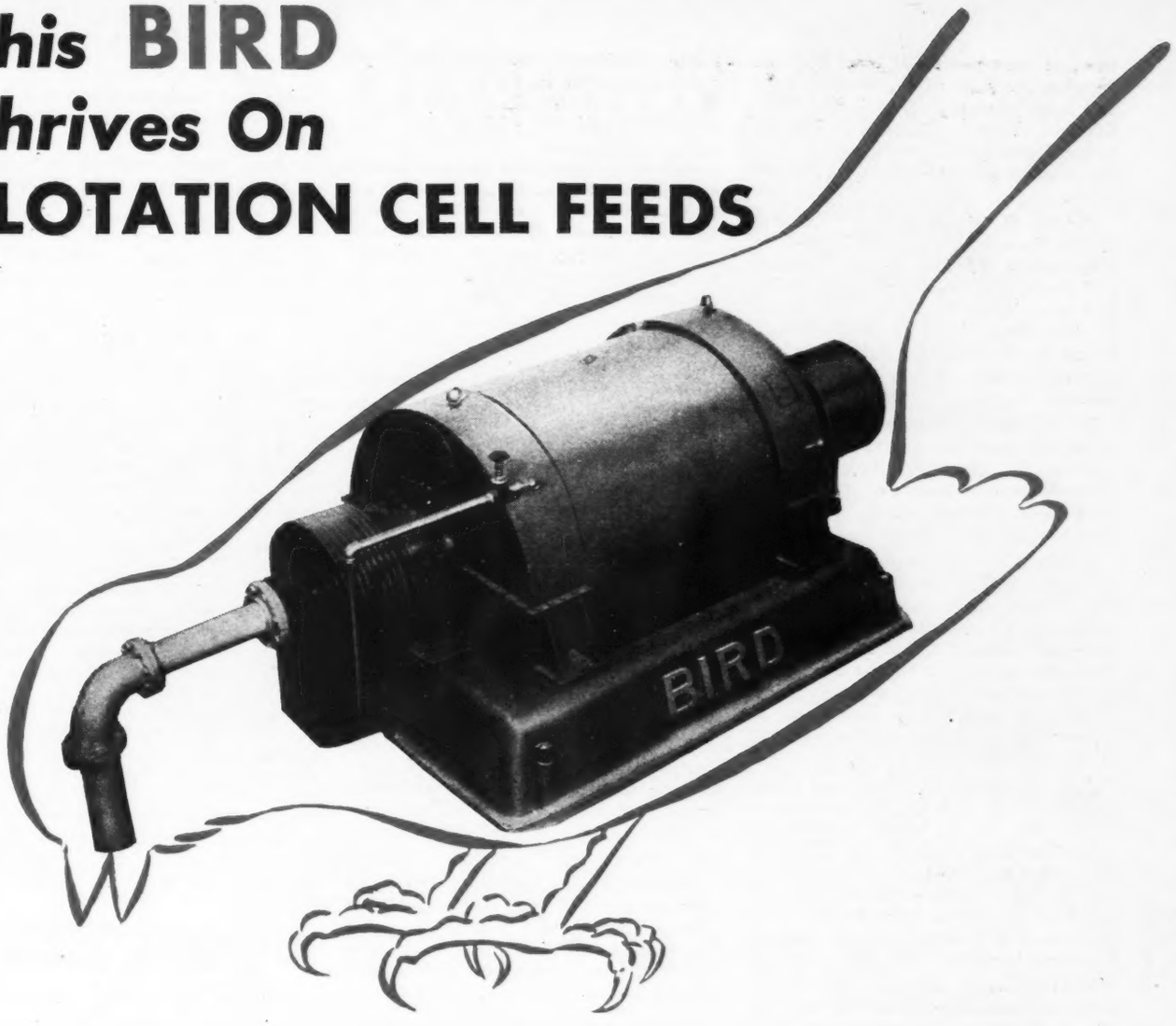
John M. Fox, consulting mining engineer, has established temporary headquarters at 1311 Norton Ave., Glendale, Calif., pending the selection of permanent quarters.

Clyde DeHaas was on Dec. 17 last elected president of the Marquette Range Engineers Club, at Ishpeming, Mich. Other officers of the club are **Harry Peterson,** vice president; **Frank Masek,** treasurer; **Peter Ribotto,** secretary, and **James Wilson, R. S. Archibald,** and **E. L. Derby,** directors.

H. R. Joesting has been appointed geophysicist in charge of the consolidation of the Division of Geophysical Exploration of the U. S. Bureau of Mines with that of the Geological Survey. The changes follow action to conform with the Department of the Interior reorganization program, designed to eliminate overlapping activities and duplication of effort in mineral exploration and development. **F. W. Lee,** chief of the former Bureau section, will henceforth devote his time to a special research in instrumentation.

E. Lee Cameron has been appointed industrial mineralogist for the Mines Branch, Manitoba Department of Mines and Natural Resources. For

This BIRD *Thrives On* FLOTATION CELL FEEDS



You can make use of this Bird Centrifugal Classifier to take out slimes as fine as 2 microns. Cell performance has been vastly improved as a result.

The BIRD does the job without chemical dispersion and it has saved up to 60% of reagent cost. It handles 100 tons or more per hour, continuously. It operates for months without maintenance shutdowns.

Why not try feeding it some of the slurry before it goes to *your* cells? For complete information, write *Bird Machine Company, South Walpole, Massachusetts.*

The BIRD Centrifugal CLASSIFIER

the last four years Mr. Cameron has been on the staff of the Ore Dressing and Metallurgical Laboratories, Mines Branch, Ottawa, engaged in metallurgical problems pertaining to both the metallic and the industrial mineral fields.

Dr. W. E. George, officer in charge of the Bureau of Medical Inspection, Department of Labor and Industry and Social Welfare, New South Wales, has returned to Australia from a visit to the United States and Canada, where he investigated the use of aluminum powder in the treatment of silicosis.

E. A. Henderson, previously plant superintendent of Australasian Aluminium Co. Pty., Ltd., has been appointed general manager of Rutherglen Gold Dumps, Ltd., and Gold Dumps Pty., Ltd., Victoria, Australia.

Ralph Tuck, geologist on the exploration staff of United States Smelting, Refining & Mining Co. in Western states, with headquarters the past six years at Silver City, N. M., has been appointed geologist in charge of the Western exploration division. Mr. Tuck is a graduate of University of Oregon and took his doctor's degree at Cornell university.

A. D. Nicholas, secretary and treasurer of Calumet & Hecla Consolidated Copper Co. for 25 years, voluntarily retired on Dec. 31 last. Mr. Nicholas, who resides in Boston, is a native of the Michigan copper district. He entered the employ of the company as a warehouse boy July 1, 1899, and had been continuously with the company since that date, having held successively all positions in the accounting and statistical departments. In April 1921, he was elected secretary and treasurer of the parent company and all allied companies, then numbering 13, and has held those positions to this time. Mr. Nicholas has been succeeded by **James H. Elliott,** who for the past three years has been assistant secretary, assistant treasurer, and comptroller. **F. J. Gibbons,** employed in the statistical department, has advanced to the positions of assistant secretary and assistant treasurer.

George H. Kemmer has been made managing director of the Philippine American Corporation, Cebu, Cebu, P. I. **Robert A. Willoughby** is chief metallurgist; **Victorino A. Zuniga, Victor E. Balotta, Louis Y. Santos,** and **Marciano V. Benedicto** have joined the staff as mining engineers, and **Louis R. Garcia** has been appointed chemist.

A series of promotions of International Smelting & Refining Co. personnel resulting from deaths in December of A. B. Young, metallurgical manager, and J. B. Whitehill, purchasing agent, is announced by Frank A. Wardlaw, Jr., general manager: **Blair L. Sackett,** general superintendent at Tooele, succeeds the late Mr. Young as metallurgical manager, with headquarters in Salt Lake City. **Carlos Bardwell,** who has been assistant superintendent at the Tooele plant, is advanced to general superintendent, and **W. J. McKenna,** formerly concentrator superintendent, moves up to assistant general superintendent and is in turn succeeded by **R. V. Kettner** as concentrator superintendent. **James H. Collins,** formerly assistant to the late Mr. Whitehill, becomes purchasing agent. **Glen A. Burt,** becomes ore buyer, a position held for many years by **D. A. White.**

Mr. Sackett, a graduate of Colorado School of Mines in 1909, has been with International since 1912, and Mr. Bardwell, University of Utah graduate in chemical engineering, started as a chemist at Tooele in June 1913. **Mr. McKenna,** Colorado School of Mines graduate in 1920, has been at the Tooele plant since graduation.

OBITUARIES

Francis William Maclennan, consulting mining engineer, and from 1919 to 1936 manager and vice president of Miami Copper Co., died in Los Angeles on Jan. 28 at age of 70.

Lee Hayes, 92, retired chief mining engineer for the Anaconda Copper Mining Co., died at Laguna Beach, Calif., on Dec. 4. Mr. Hayes succeeded the late August Christian in 1914 and retired in 1924.

George A. Des Rosier, of the engineering staff of the Virginia, Minn., mine of the Snyder Mining Co., died at Virginia on Dec. 21 last at the age of 46. He had been with the company on the Mesabi Range since 1915.

Frederick Phillippi, 44, Cadiz, Ohio, retired mining engineer, died recently at Palm Beach, Fla.

Guy E. Slover, for many years employed with the Phelps Dodge Corp., died recently in Morenci, Ariz.

James B. Whitehill, 67, purchasing agent for International Smelting & Refining Co., Salt Lake City, and employed by Anaconda Copper Mining Co. for 47 years, died recently.

A. Burgess Young, 61, metallurgical manager in charge of International Smelting & Refining Co. metallurgical operations in Utah and a grandson of Brigham Young, second president of the Church of Jesus Christ of Latter Day Saints (Mormons), died Dec. 14 last.

F. W. Bradley, San Francisco mine executive and operator, who, before his death in 1933 was head of Bunker Hill, Alaska Juneau, and other mining concerns, and who was president of the A.I.M.E. in 1929, was honored posthumously on Dec. 14 last when the air field at Boise, Idaho, was officially designated "The Bradley Airport." The new field is occupied by Aircraft Service Co., of which John D. Bradley, son of the late F. W. Bradley, is president.

Prof. Bancroft Gore, formerly on the staff of the Montana School of Mines and later manager of a copper smelter in Chile, died in Rapid City, S. D., on Dec. 8 last. He had been on the staff of the South Dakota School of Mines for the past 25 years.

H. Joseph La Page, 57, chief engineer for the Inter-State Iron Co., died at Hibbing, Minn., on Nov. 12 last. He had been an employee of the Inter-State company for 34 years.

C. W. "Billie" Moore, one of the best known prospectors, miners, or mining engineers in western Canada, died at Wells, B. C., early in December at the age of 81. Going to Dawson in the "Trail of '98," he remained in Yukon for 16 years, during which time he became one of the first dredgemasters in the Territory.

Leon H. Barnett, retired mining engineer, an alumnus of Columbia (1894), inventor of a process for the artificial production of diamonds, and formerly active in the mining districts of Colorado and Vermont, died recently in New York at the age of 76.

W. Bemis Phelps, mining engineer, one-time general superintendent of South American Development Co., Portovelo, Ecuador, S. A., general manager of Tom Reed Gold Mines, Oatman, Ariz., and general superintendent of Getchell Mine, in Nevada, died in Altadena, Calif., on Dec. 3 last, aged 62.

An Appreciation of Karl M. Stewart

Included among the many mining men lost on the Jap prison boat sunk by our air forces in Subic Bay on Dec. 15, 1944, was Karl M. Stewart.

A native of Spokane, Wash., Mr. Stewart graduated from the University of California, at Berkley. He followed his profession as a mining engineer in various Western states and in Peru, S. A. Arriving in the Philippines in 1934, Mr. Stewart was connected with the Benguet Consolidated and Soriano interests in various capacities from shift boss to general superintendent. In 1936 he joined the Nielson interests as assistant general manager, which position he held until Manila was attacked. He joined the American forces on Bataan and was commissioned a lieutenant of engineers.

After the fall of Bataan and Corregidor, Mr. Stewart was imprisoned in various military prisons on Luzon until his death.

Mr. Stewart combined a pleasing personality with technical ability far above the average, and his loss will be keenly felt by his many friends in the islands, Nielson & Co., in particular, and the mining profession in general in the Philippines.

SAM COLDREN,
CHAS. A. MITKE.

Manila, Dec. 22, 1946.

REGISTRATIONS *SHOW* IT—
OPERATORS *KNOW* IT!

This Ford 134-inch wheelbase 2-ton unit, with dual-range rear axle and auxiliary springs, is equipped with six-by-eight-foot Dump body and hoist by Gar Wood Industries, Detroit, Mich.

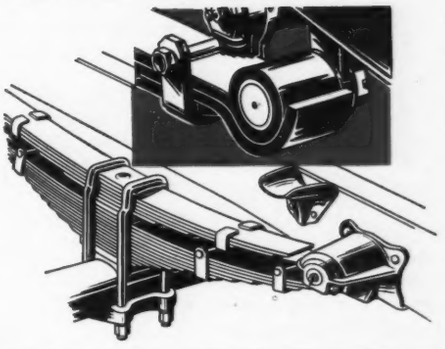
90 6 H.P.
YOUR PICK OF POWER
100 V-8 H.P.

"FORD TRUCKS LAST LONGER!"

ONE big reason:

FORD SPRINGS STAND UP!

Ford spring engineering provides unsurpassed endurance. Ford special alloy spring steel, with tensile strength of 200,000 pounds per square inch, assures high fatigue resistance, while deflection rates scientifically proportioned to each vehicle's gross weight assure good riding with generously ample load capacity. Long-wearing shackle bushings of steel-backed bronze reduce maintenance expense. Ford special, wrapped "safety eyes" on heavy duty front springs (illustrated) reduce stress on main leaves, afford longer life and extra safety. Hydraulic *double-acting* shock absorbers on light duty models further ease the ride and control the load.



Ford

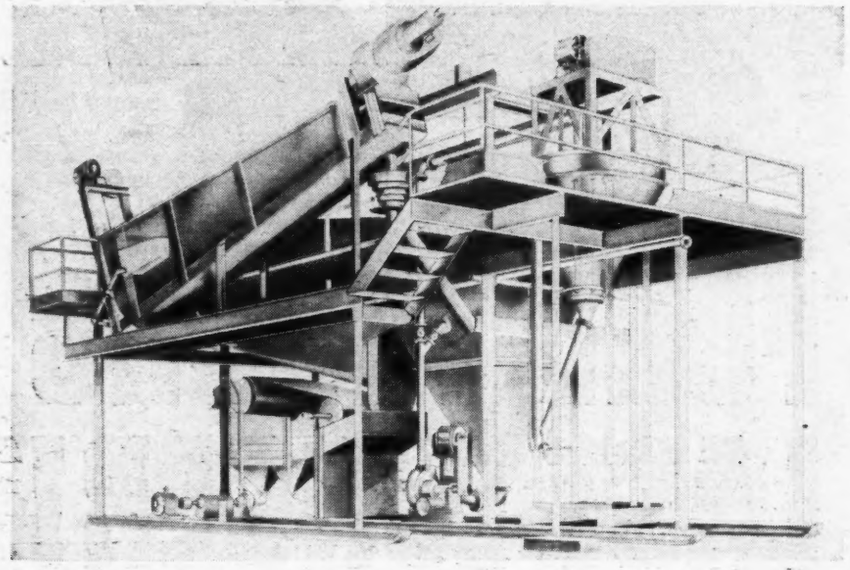
ONLY FORD GIVES YOU ALL THESE LONG-LIFE TRUCK FEATURES: Your choice of two great engines, the 100-H.P. V-8 or the 90-H.P. Six—semi-centrifugal clutch that needs no maintenance lubrication—rear axle design that takes all weight-load off the shafts (¾-floating in half ton units, full-floating in all others)—heavy channel section frames, *doubled* between springs in heavy duty models—big, easy-action brakes, with heavy, cast drum surfaces, non-warping and score-resistant—extra-thick sheet metal in cabs, cowls, skirts and fenders—all told, more than fifty such examples of Ford endurance-engineering. That's why FORD TRUCKS LAST LONGER . . . why 7 out of 11 of all Ford Trucks built since 1928 are still in service. No wonder the average age of all Ford Trucks in use is nearly 9 years! Stamina is built into them! See your Ford Dealer NOW!

FORD TRUCKS

MORE FORD TRUCKS IN USE TODAY THAN ANY OTHER MAKE

EQUIPMENT NEWS

Semi-Portable HMS Plant



Development of a semi-portable Heavy-Media plant, known as the Mobil-Mill, is announced by Western-Knapp Engineering Co., 760 Folsom St., San Francisco 7, Calif. Designed for pilot-plant work, or for use in small dump operations, the unit can be quickly assembled in the field and then later dismantled and moved to a new site, with little effort and relatively low cost.

The plant occupies an area of 12½x 26 ft., it is 13½ ft. high, and capacities range from 5 to 15 tons per hour, depending on type of material handled. Selection of equipment used is based on analysis of operating HMS plants, and design is based on experience and operating data gained by company engineers in constructing HMS plants throughout America. The design meets American Cyanamid Co. standards. The plant can be acquired either by outright purchase or on a rental basis.

Speedy Copying

Anything drawn, typed, printed, or photographed on translucent material can be copied as a positive print in 25

seconds in the new Ozalid streamliner, a recent addition to the line of positive-printing, dry developing machines made by General Aniline & Film Corporation, Johnson City, N. Y. No chemical baths or inks are used, and dry prints of engineering drawings are delivered ready to use after only two operations: exposure and dry development. Lines or images can be reproduced in black, blue, red, sepia, or yellow on paper, cloth, foil, film, or plastic. The unit is also said to be simple and economical to operate. Full details will be furnished by the manufacturer.

Rechargeable Spotlight

A new and improved model of the Wheat rechargeable spotlight for general or emergency use in mines or other industries has been announced by Koehler Manufacturing Co., Inc., Marlboro, Mass. The battery used is a 2-cell, 4-volt, lead-acid type, and 25,000 candle-power is furnished in a spot- or floodlight as desired. The unit will burn a high-power bulb for 6 hours or a lower-power bulb for 12 hours.

Loader Lubricant

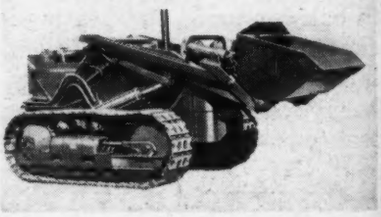
Practically all needs of cutting and loading machines in coal and metal mines are said to be met by a new all-purpose lubricant recently announced by Gulf Oil Corporation. Called Gulf mining machine Lubricant B, the new product is a heavy-bodied quality lubricant that provides efficient protection for spur, worm, and bevel gears, and for moving parts supplied through pressure fittings. Special advantages cited are less mechanical leakage, longer life, greater tenacity, and effective lubrication under water conditions.

Gas Welders' Goggles

Acetylene welding or cutting usually involves much shifting of goggles back and forth from eyes to forehead, a procedure which appears to have been simplified in the form of the new Speed-Shift goggle recently announced by Chicago Eye Shield Co., 2300 Warren Blvd., Chicago 12, Ill. A quick flip of one hand is said to be all that is required to adjust the new goggle to the desired location. Spectacles may be worn without interference.

Bulldozer-Shovel

An improved design of the Hough shovel or bulldozer has been announced by Frank G. Hough Co., Libertyville, Ill. Built specifically for

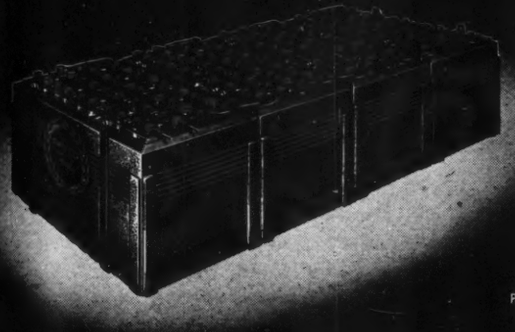


Extra Power for Extra Production

Mechanized mining scored one of its greatest gains when Philco pioneered the modern extra capacity storage battery.

Extra power to haul more tons per shift—day in and day out! 10% or more additional capacity in the same space!

The great new Philco "Thirty" Mine Battery has this modern extra capacity advantage. In addition it gives longer life under the toughest operating conditions. Write for specification data.

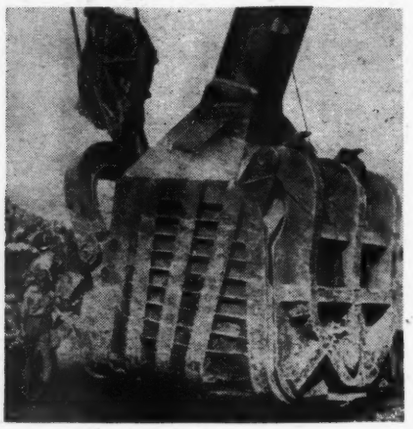


PHILCO

STORAGE BATTERIES

PHILCO CORPORATION • STORAGE BATTERY DIVISION • TRENTON 7, NEW JERSEY

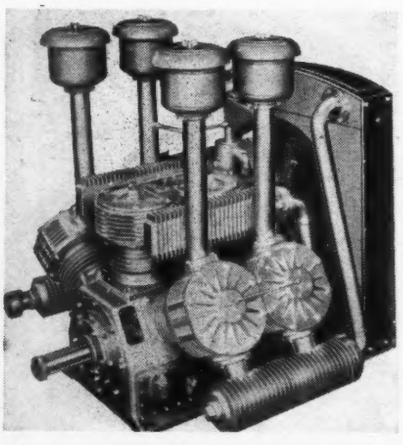
the International T-9 or TD-9 Trac-TracTor, the new Model 9-A may be equipped with either a full track width 1-yd. bucket or a bulldozer blade. Operation is hydraulic and overhead and side structures have been eliminated. Unique design of push arms provides powerful crowding action and a fast hoist for the bucket. A long, high-dumping reach is provided. Ask for catalog No. 164.



WORLD'S LARGEST shovel dipper was recently completed by Marion Power Shovel Co., Marion, Ohio, for the Hanna Coal Co., Cadiz, Ohio. With a capacity of 40 cu.yd., the dipper is used on a former 35-yd. shovel in a coal-stripping operation. Use of new steels permitted construction of a larger dipper without increasing the loaded weight.

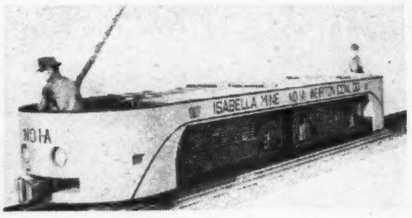
Lightweight Compressors

Aluminum alloy compressor heads and manifolds and aluminum crankcases are used in the new line of portable air-cooled compressors just announced by Davey Compressor Co., Kent, Ohio. Because aluminum possesses three times the rate of heat conductivity of cast iron, these new compressors are cooler in operation, as well as lighter in weight, than other types and are said to provide permanent freedom from valve carbonizing. The line, which includes five models of from 60 to 315-cfm. capacity, marks the 25th anniversary of Davey's introduction of the world's first air-cooled portable compressor.



High-Speed Mine Motor

Heavy fast haulage over long runs is the special field for the 25-ton, 480-hp. mine locomotive recently announced by the Transportation Division of General Electric Co., Schenectady, N. Y. The motor is of all-welded steel construction, and it has a top speed of 40 mph. Each axle is driven by a 120-hp., 250-v., heavy-duty traction motor, and the locomotive develops 12,500-lb. tractive effort.



INDUSTRIAL NOTES

Le Roi Co., Milwaukee, Wis., announces the purchase of **Cleveland Rock Drill Co.**, Cleveland, Ohio. **Russ Morgan** will head the new organization.

Nichols Engineering & Research Corporation announces the appointment of **F. B. Schilling** as vice president in charge of sales and general manager; of **R. W. Rowen** as vice president in charge of engineering and research; of **S. Burgess** as vice president in charge of field operations.

Mack Mfg. Corporation announces the following appointments: **A. C. Fetzer**, vice president, to the board of directors as general sales manager; **Leonard E. Matzner** as advertising manager.

The export organization of **R. G. LeTourneau, Inc.**, has been expanded and its headquarters have been moved to New York from Peoria, where **Paul Fulford** will be in charge.

Arvid Peterson, chief engineer of the centrifugal pump and compressor department of the **De Laval Steam Turbine Co.**, Trenton, N. J., died Dec. 19, 1946, after a short illness.

Martin Meyer has been appointed as assistant to **D. D. Guilfoil**, general sales manager of **Sauerman Bros., Inc.**, Chicago, Ill.

Drott Mfg. Corporation, Milwaukee, Wis., makers of tractor-mounted equipment, announces completion of new office and manufacturing buildings at 4344 North Green Bay Ave., Milwaukee.

William B. Gold, purchasing agent for **Electric Storage Battery Co.**, Philadelphia, Pa., died on Dec. 15. He had been with the company 46 years and became purchasing agent in 1913.

A. P. Green Fire Brick Co., St. Louis 1, Mo., has organized an engineering and management company to give assistance to selected individuals or companies interested in starting firebrick or allied clay products plants outside the United States.

James V. Thompson has been transferred from the development department of **The Dorr Co.** to the sales division, with headquarters in the **William Oliver Bldg.**, Atlanta, Ga.

Albert C. Walsh has retired after 26 years of service as purchasing agent for **Timken Roller Bearing Co.**, Canton, Ohio.

Herbert H. Smith has been promoted to sales agent in the mine and industrial division of **National Malleable & Steel Castings Co.**, Cleveland, Ohio.

BULLETINS

Rubber-Lined Pipe. A catalog section on all its standard pipes and fittings lined with rubber by the Vulcalock process has been published by B. F. Goodrich Co., Akron, Ohio.

Rubber-Covered Cable. Data on the reasons for their decision to stay with synthetic rubber in producing insulated wire and cable are presented in "Our Third Report to Industry," published by Simplex Wire & Cable Co., 79 Sidney St., Cambridge 39, Mass.

Pipe. Pipe in American life is the subject of a 48-page booklet available without charge from American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y.

Crushers. Jeffrey double roll crushers for breaking friable materials to 1½-in. size are described in a new catalog issued by Jeffrey Mfg. Co., Columbus 16, Ohio.

Pumps. Pumps for all industrial uses, including mines, are thoroughly discussed in a 35-page bulletin (No. 446) recently issued by Nagle Brothers, Chicago Heights, Ill.

Eye Safety. A new eye safety guide, including recommendations for protection against various hazards, has been issued by American Optical Co., Southbridge, Mass.

Diesel-Electric Plants. A new booklet (Form 9489) of Caterpillar Tractor Co., Peoria 8, Ill., describes the increasing use of diesel-electric power for various community and industrial purposes.

Welding. Air Reduction Sales Co., 60 East 42d St., New York 17, N. Y., announces publication of a new 64-page general catalog of its welding and cutting products, both gas and arc. Prices are included.

Chimneys. Photographic evidence of the way in which Weber-built chimneys withstood the blast of the atomic bomb at Nagasaki is presented in a leaflet issued by Weber Chimney Co., 332 South Michigan Ave., Chicago 4, Ill.

Earthmoving. A 12-page folder (Form TP-126) has been issued by R. G. LeTourneau Inc., Peoria, Ill., describing applications of the company's Tournapull.

Arc Welding. Specifications and construction details on the company's complete line of a.c. transformer-type welders are given in a new booklet (B-3548) published by Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

Floor Repair. The Stonhard Co., 401 North Broad St., Philadelphia 8, Pa., has prepared a new folder describing use of Stonhard heavy-duty resurfacer in the repair and resurfacing of floors, traffic aisles, and platforms.

When the going gets tough...

You need a man like this. He's your Industrial Supply Specialist. He knows that your ore and other bulk materials must always be moved fast and efficiently.

He knows, too, that you can't afford to run the risk of costly shutdowns caused by inefficient conveyor belting or machinery. That's why you can count on him to recommend equipment that will withstand severe punishment . . . carry more tons per dollar.

When you have to move heavy loads of sharp, jagged ore, for example, he will recommend Monarch Conveyor Belting and Robins Conveyors. They're "Job-Engineered" by Hewitt-Robins to withstand impact loading.

You see, Hewitt-Robins offers you complete materials handling service . . . backed by a single source and single responsibility for both conveyor machinery and belting.

So, *before* the going gets tough, call your Industrial Supply Specialist. He will recommend the Hewitt belting best suited to do your job cheaper, faster, and better.

Specify "Hewitt" . . . Phone the Hewitt distributor listed in the classified section of your phone directory. Or write to Hewitt Rubber of Buffalo, 240 Kensington Ave., Buffalo 5, N. Y.

Monarch Conveyor Belting

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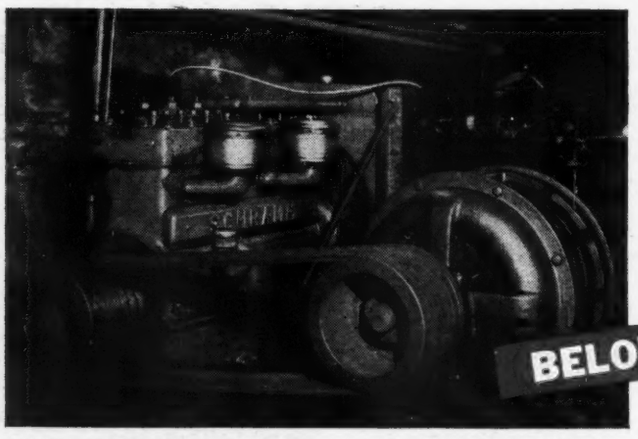
"JOB-ENGINEERED" INDUSTRIAL HOSE • BELTING • PACKING

SCHRAMM

PACKAGED AIR FOR THE MINING INDUSTRIES

AT THE SURFACE OR..

Mining Engineers want ruggedness and dependability in an air compressor, portable or stationary . . . at the surface or down in the shaft. That's exactly what Schramm provides . . . plus four special features built into every Schramm Air Compressor: 1. 100% Watercooled, 2. Compact—Lightweight, 3. Mechanical intake valve, and 4. Forced feed lubrication.



BELOW

Write today for performance and construction details on these rugged, dependable units. We believe Schramm compressed-air-power will help make your mining operations easier.

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

Non-Metallics

(*Continued from page* 107)

poses is an outstanding example.

Sodium Chloride. From the standpoint of tonnage consumed in the heavy-chemical industries, salt stands next to lime and limestone. The quantity used for all purposes in 1946 was approximately 6% below that of 1945 but fully 50% more than that consumed in the years immediately preceding the war. There is reason to believe, however, that the demand for certain purposes will drop in 1947.

MISCELLANEOUS. Space does not permit full consideration of many industrial minerals that are growing in importance and use. This is true particularly of those employed in paints and pigments, as flame-resisting compounds, and for waterproofing.

After several months of pilot-plant operation a company in Seattle, Wash., is now ready for commercial production of fertilizer made from olivine obtained from Cypress Island, in the San Juan Archipelago, Wash., and phosphate rock from Montana.

Refractory blocks that stand up well at 1,500 deg. C. have been prepared at the Norris, Tenn., Station of the Bureau of Mines by mixing 5 to 10% of magnesite with olivine, using sodium silicate as a binder, and firing at a temperature of 1,200 deg. C.

The output of barite has increased because of the expanding oil-well drilling program. Technical improvement have been made in the type of log washers used in the Missouri fields. Arkansas again is the leading producer, followed closely by Missouri. The Baroid Sales Division of the National Lead Co., at Magnet Cove, has started underground mining and the Magnet Cove Barium Corporation has begun an extensive stripping program.

Several lithium compounds were made available to industry in 1946. They are: lithium peroxide, a solid of high stability containing about 35% of available oxygen by weight; lithium borohydride, a solid stable in dry air and capable of generating 66 cu. ft. of hydrogen per pound on contact with water; and lithium diborane, a gas which, at room temperature, liberates 78 cu. ft. of hydrogen per pound on contact with water. The Texas Company announced a new, synthetic low-temperature grease with a lithium base which is stable, in temperatures from −100 deg. C. to +300 deg. C.

REGIONAL NEWS

CALIFORNIA

American Potash & Chemical to build $4,500,000 plant—North Star resumes leasing

★Louis F. Madru, following acquisition of the historic Canyon Creek placer holdings from George Bergin and wife, of Weaverville, Trinity County, has completed the repair of flumes and ditches and installed auxiliary equipment as a preliminary to early large-scale hydraulic placer-mining operations. The placer holdings are situated in the Canyon Creek area of Trinity County, and cover about 1,750 acres. Water for the hydraulic giants and sluices is obtained from Canyon Creek, the Big and Little East Forks, and Gwin Gulch.

★Harms and Larson, of Sacramento, are currently operating two dragline dredges in Siskiyou County. One, with R. Barrett, superintendent in charge, is on Horse Creek, and the other, directed by R. C. Henrici, superintendent, is on the Klamath River about 1½ miles below Happy Camp. Pay gravel proven so far assures a 1½ year run. Some 30 men are employed at the two dredging sites.

★A new camp to accommodate from 10 to 15 men has been completed at the old Nash placer mine, on Coffee Creek, Trinity County, and installation of an electric-powered dredge and equipment for leveling tailings is nearing completion. The property is worked by the Meyer Co. and associates, of Los Angeles.

★Equipment has been installed at the Maid of Orleans gold mine, near Alleghany, Sierra County, to permit operation throughout the winter. The property was recently acquired by Irving D. Wolf and associates. Development work has disclosed good milling ore. George Bartlett, superintendent, is in charge of operations.

★Installation of a mill of 80 to 100 tons capacity at the Brush Creek gold mine, near Goodyears Bar, Sierra County, is planned by Alfred L. Merritt, the operator. The mine has been under development for some time, and a substantial gold production was made during previous operations. Denman Dorr is superintendent.

★G. L. and Donald Read plan to operate the Sandusky drift gravel mine, two miles west of Forest, Sierra County, as soon as sufficient water is available. Drifting is in progress from a 72-ft. vertical shaft, and equipment recently installed includes a hoist, air compressor, and fan and pump equipment. The mine is near the Yellow Jacket, Old Colony, and Kirkpatrick gold properties, and the present operators plan eventual installation of electric power, driving of a 1,200-ft. bedrock tunnel, and underground hydraulic mining.

★According to a recent announcement by B. R. Armour, chairman of the board, American Potash & Chemical Corporation, work is scheduled to start soon on a new $4,500,000 unit at Trona, San Bernardino County, which will utilize a new process and increase production by about 60,000 tons of soda ash and 30,000 tons of borax annually. The new process developed by the company's research and production staffs will handle hitherto unused and secondary Searles Lake brines. Mr. Armour also pointed out that the demand for soda ash and borax has mounted significantly in the eleven Western states, and expects the percentage of production going to these states (38% of domestic tonnage in 1945 went to customers in these states) to continue to rise.

★Permanente Metals Corporation, Henry J. Kaiser, president, will start construction of a new plant near Cartago, Inyo County, for production of soda ash as soon as weather conditions permit. Preliminary operations are in progress under the direction of M. Eisele, construction superintendent, Los Angeles, and following approval of a power load of 800 hp. by the City of Los Angeles, plans include construction of an electric power feeder line to the plant site, and housing and mess accommodations. The completed project will provide employment of about 35 men, of which the greater part will be engineers and technicians.

★Milling operations are scheduled to start soon at the Gaston mine, near Washington, Nevada County, operated by the Tonopah Divide Mining Co. Daily production from shrinkage stopes now under preparation is expected to run around 100 tons. Broken ore will be hauled by electric locomotive and cars to the mill through the 4,759-ft. main tunnel rehabilitated recently. The Gaston property comprises 20 claims and is situated near the Ancho-Erie, Eaglebird, Maybert, and Yuba gold properties. The company is also conducting exploratory and development work at the adjacent Giant King gold mine.

★Leasing operations will be resumed in the North Star mine, according to an announcement by the Empire Star Mining Co. on Jan. 1. Three groups of eight miners each will be permitted to conduct leasing operations in No. 5 winze. This winze reaches to a depth of 11,000 ft. on the incline, or 5,500 ft. vertically, and is the deepest working in the mine. Since shutting down in July 1946, the North Star, as well as the Empire and Pennsylvania mines of the company, have been maintained in condition to operate.

★Claims for $300,000 in retroactive portal to portal pay were filed on Jan. 3 against the Mountain City Copper Co., Ltd., Shasta County. The complaint, filed by the Nevada County representative of the International Union of Mine, Mill and Smelter Workers and two employees of the company, alleges that 67 workers are entitled to $4,479 each, from October 1938, for the 45 minutes required to reach the mine from their homes or the mine bunkhouse, plus time spent in changing clothes.

NEVADA

Dayton Consolidated to reopen Silver City mill—Small-mine operators organize

★The bucket-line dredge of the Manhattan Gold Dredging Co., subsidiary of the Natomas Co., has reached a point at the head of the canyon where old mine dumps block further progress and the bucket-line, gantry, and twin waste-stackers have been removed. John L. James, manager, reports test drilling still in progress on the alluvial fan below the canyon outlet, but if the results warrant returning the boat down the canyon to the flat terrain, a dragline will be employed to dig the needed channel. The dredge has a capacity of 12,000 cu.yd. on a two-shift basis. Natomas is preparing to operate a dragline and washing plant on the J. O. Greenan placers in lower Copper Canyon, Lander County, and will provide a bucket-line unit, possibly the one below Manhattan, for the deeper gravel that is found on the flat area below.

★Deep drilling, conducted by the Utah Construction Co., is in progress on formerly productive gold and silver mines at Tuscarora, Elko County, credited with early production of around $40,000,000. Deeper extension of old workings involves a water problem, as mine levels below 600 ft. were below the elevation of the

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Nevada *(continued)*

valley floor and the bed of the Owyhee River, which drains the area. Old mines being drilled or to be drilled include the Dexter, Grand Prize, Navaho, Belle Isle, and others, held under option.

★Dayton Consolidated Mines Co., Homer L. Gibson president, has repaired workings in ore on the 600- and 700-ft. levels of its New York shaft and is conducting extensive drilling with the purpose of soon reopening its 175-ton cyanide mill at Silver City, in the Comstock district. The mill, prior to L-208, was the foremost Nevada processor of custom ore. Between 1938 and its enforced shutdown, Dayton Consolidated shipped bullion with a value of $6,274,704 recovered from its own and custom ores.

★Consolidated Coppermines Corporation on Dec. 16 paid a dividend at the rate of 10c. per share. John A. Payne, president, lately informed stockholders that the company is engaging in fabrication of metal products, having purchased control, said to be 70%, of Titan Metal Manufacturing Co., of Bellefonte, Pa. Titan Metal operates four major-scale plants at Bellefonte, producing brass and bronze forgings, welding alloys, and related products.

★Mining claims covering a large area in the northeastern part of the Tonopah district were purchased recently from Nye County and individual owners, for unnamed clients, by M. A. Diskin, of Reno, attorney and former State Attorney General. The claims, nearly all patented, had reverted to county ownership for unpaid taxes. To acquire title to the properties, the Tonopah Development Co. has filed articles of incorporation.

★Driven under contract, a deep-level tunnel on the old Berlin mine, in northern Nye County, owned by J. Phelps Stokes, of New York, was reported nearing its objective at 400 ft., where it is designed to explore an ore zone worked in the '80s on upper levels with substantial production of silver and gold.

★Operation of several mines in the old Searchlight camp, in Clark County, has been consolidated with recent organization of the Searchlight Consolidated Mining & Milling Co. Homer C. Hills, president, reported the new concern had acquired the Quartette, Blossom, and M. & M. mines, gold producers of note in earlier years. A 100-ton flotation-cyanide mill is to be provided.

★Hoisting equipment and buildings have been prepared by the Nevada Equity Mining Co. at the old Hillside incline shaft near Lander Hill, at Austin. The shaft, partly caved, is to be cleared, prospect work and sampling conducted on the formerly productive Panamint vein, and connection made with the 1,700-ft. Equity tunnel, lately opened and repaired. Robert H. Raring, vice president of Equity and of the Copper Canyon Mining Co., is directing engineer and W. L. Peterson is superintendent.

★The old Johnnie gold mine, in southern Nye County, is said to have been sold to California operators and is to be reopened at depth. Credited with early production of around $7,000,000, the property in earlier years was thought to have been the widely publicized "lost" Breyfogle mine.

★A movement is under way to organize an association of Nevada small-mine operators, claim owners, and prospectors, on lines that have been highly successful in Arizona. Newly elected representatives at Washington are concerned with the welfare of mining and notably with difficulties arising from current administration of the Securities Act. Meetings will soon be held.

COLORADO

Pitchblende ore reported under development—Ajax ships high-grade gold ore

★A new orebody has recently been encountered in the Lady Franklin Mine, near Silver Cliff, according to Ed Stacy, superintendent. A crosscut has penetrated 28 ft. into the ore. Samples taken indicate average values of 55 oz. silver to the ton, with a lead content of 6%, he reports. The body of ore was found on the 286-ft. level and is on a junction of the Lady Franklin and Luella veins in virgin territory. The Lady Franklin, operated by George L. Beardsley, former Westcliffe banker who now resides in Colorado Springs, has been producing ore for some time. "We have been shipping a carload of ore per week," said Superintendent Stacy, "and can easily increase that to two cars with our present crew of twelve men, provided weather conditions will permit transportation to Texas Creek."

A new shaft was sunk about 300 ft. on the Lady Franklin property during 1946. New machinery was installed and an electric power line built to the property.

★The Cottonwood Mining Co., operating the Quaker claims, about twelve miles west of Buena Vista, in the South Cottonwood mining district, has advanced its tunnel 240 ft. to the hanging wall of a vein that appears to average about 3½ ft. in width. The ore encountered assays 40% lead, 11 oz. silver, and traces of copper and zinc. Present work consists of building a better road to the portal in order to install modern equipment. O. O. Morris and associates, of Buena Vista, own and operate the property.

★The Malachite copper mine, on Genesee Mountain, is now shipping

ore to its mill near Idaho Springs. It is reported that the ore will later be treated in the mill at Dumont, where a larger daily tonnage can be put through. R. M. Moore, of Idaho Springs, and G. G. Gowan, of Fort Worth, are operating both mine and mill.

★Pitchblende ore, the source of uranium, has been discovered in the Grand Island mining district covering the famous old Caribou silver mining camp, northwest of Nederland, in western Boulder County, reports from Boulder state. County records show that the newly organized Consolidated Caribou Silver Mines, Inc., has acquired a large acreage of patented and unpatented mining claims in the district. The company is said to have already spent some $50,000 on development and plans a total expenditure of between $400,000 and $500,000. Elmer W. Hetzer, of 2045 Mapleton Ave., Boulder, is manager of operations at the properties. It is reported that the New York principals of the company are interested in the mining of pitchblende in the Great Bear Lake district of Canada.

★Several shipments of high-grade gold ore from Cripple Creek mines are reported in recent returns from the Golden Cycle mill. A carload of ore shipped from the Ajax mine on Nov. 26 ran $455 in gold to the ton, according to the settlement sheet received by Earl Bebee, superintendent of the property. The ore came from the 28th level of the mine. Another 40-ton car of ore, also from the 28th level, settled at $352 in gold to the ton. The 28th is the lowest level, and the ore is mined from an area drained by the Carlton tunnel and opened up since its completion. The Ajax is a Golden Cycle Corporation property and is operated on both company and lessee account.

★Tungsten mining in Boulder County is showing little activity at present, but the demand for the metal for use in high-speed tools should improve as reconversion progresses, it is believed by Boulder operators. William Loach is the principal local buyer. George Teal is also in the market. The Vanadium Corporation has two leases on its Conger property, one of the oldest and most productive tungsten mines in the district. The last year of operation consisted mainly of milling reserve ore and stope fill. Prospect work at 1,300 ft. depth is said to have opened little ore. Robert Sterling is manager for the Vanadium Corporation at Boulder. Wolf Tongue Mining Co., with William Loach as general manager, has been carrying on a prospecting program by driving a 1,500 ft. crosscut tunnel under the Hurricane Hill district which has opened some ore.

★Risden Engineering & Mining Co., A. E. Risden, president and manager, reports progress at its mine at Ward and that mill construction has been

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Colorado (*continued*)

completed. A winze is to develop the Spike vein structure where recently values of 190 oz. gold and 31 oz. silver per ton were cut. A drift is being run to contact ore developed through the upper shaft with average values of 2½ oz. gold and 4 oz. silver per ton. The mill went into production Dec. 1. Pilot tests show a 17 to 1 concentration ratio.

★The Sun and Moon property, at the head of Gilson Gulch in Clear Creek County, is reported to have been acquired by William A. Lamp, of Denver, and associates. Plans for mine development are being drawn and will include sinking a new shaft under the dump to connect with old workings. A portion of the dump will be milled.

★Carter Mines Co., operating the Carter gold-silver-lead mine four miles north of Ohio City, is milling about 50 tons of ore a day with 25 men employed in the mine and mill. S. F. Wickham, of Salida, is general superintendent and Ray MacDonald is superintendent at the mine and mill. A 200-hp. diesel engine was recently installed to supplement present water power.

★The famous old mining camp of Creede is again assured of a substantial silver-mining operation when the three-mile transportation tunnel is completed at the property of the Emperius Mining Co. Properties consolidated under the company include the Amethyst, New York, Volunteer, Commodore, Bachelor, Pittsburg, Kanawha, Del Monte, Texas Boy, Little Bear, Equinox, Windsor and Happy Thought. The company operates its own power plants for mining, milling, and shop work. Milling operations are running at about one-third capacity, due to manpower shortage, but it is anticipated that production in 1947 will total at least 40,000 tons. H. T. Poxson is president, and Erich Nelson, of Creede, general manager.

ARIZONA

State Copper Tariff Board files brief—Fluorspar properties developed near Aguila

★The Arizona Copper Tariff Board, Sam H. Morris, chairman, has presented to the Committee on Reciprocity Information a formal brief in opposition to any reduction in the present excise tax on copper. The brief has been forwarded to Washington. Morris has requested permission to appear before the committee as representative of the Arizona Copper Tariff Board when formal hearings start.

The Board believes that duty-free copper means curtailed domestic production, which, in turn, will retard recovery and reconversion and endanger national security.

Of particular interest to Arizona people are the figures given on mine expenditures in Arizona for 1945 in comparison with those made in 1938, as reported by the leading copper producers. In 1945 wages and salaries accounted for a total of $24,104,545, compared with $12,938,000 in 1938; supplies and equipment, $4,112,393, against $2,599,000 in the earlier year. Taxes in 1945 amounted to $3,143,959, compared with $2,827,000 in 1938. Freight and miscellaneous items added $8,823,870 to the 1945 payments, for a grand total of $40,184,768. The grand total in 1938 was $21,590,000.

With reference to the effect of copper prices on Arizona's tax income, the brief made the following statement:

"To illustrate the enormous importance of the price of copper on the economy of the State, attention is directed to the wide difference in the assessed valuation of Arizona's mines brought about by changing levels in metal prices. . . . Thus, in 1938, when the average price of copper was 9.8c. per pound, only 97 mines were in operation and the total assessed valuation of mining property in the State was $90,035,468. In 1945 there was an entirely different picture. The ceiling price of copper had been set at 12c., with higher premium prices allowed for mines with high-cost production. In that year Arizona had almost 300 producing copper mines and the assessed valuation had increased to $147,557,326. This amounted to 30.15% of all taxable property in the State."

★The Arizona Magma mine, about two miles west of Chloride and now held by Great Western Exploration Co., is to have the benefit of a geological survey, to be followed by a diamond-drilling campaign. The property has a complete mining plant, including a small mill. The location of a proposed new shaft will be determined by the survey.

★Bob Lutz, of Phoenix, has disclosed that the Buckeye Apache mine, southwest of Bowie, is in operation and negotiations are under way for the purchase of equipment for further development. The company expects to put in a mill of 150 tons per day capacity to serve as a pilot plant for later expansion of mill size. Present plans call for full operation of the mine some time during the coming summer.

★The Douglas smelter of Phelps Dodge Corporation has become a separate branch of the corporation to be known as the Phelps Dodge Corporation, Douglas Reduction Works. Mines in Bisbee will be known hereafter as the Phelps Dodge Corporation, Copper Queen Branch. M. G. Fowler will be in charge of the Douglas Reduction Works with the title of superintendent and H. C. Henrie will con-

tinue in charge of the Copper Queen Branch with the title of general superintendent.

★The Western Perlite Corporation, Phoenix, is constructing a 50-ton treatment plant designed to handle the output of its 32 claims near Buckeye and others near Superior. The plant consists of a crusher, bins, screens, and two parallel furnaces. Capacity can be increased to 250 tons daily by installing additional rotary furnaces.

★The Le Roy mine, at Dos Cabezas, has been leased by C. W. and James Dorsey, who expect to start production soon. The last 1,000 tons of ore shipped was rated high in lead, silver, and gold.

★Development work is being conducted at the White Chief and Snow Ball fluorspar properties, south of Aguila. Recent core drilling is reported to have indicated extensive deposits. Officials are planning to install a 150-ton mill at Salome at a cost which is estimated at approximately $160,000.

★Stockholders of the Van Dyke Copper Co. have approved the sale of the company's properties to the Anaconda Copper Mining Co. for $5,000,000 under a lease and option to purchase agreement. Future development plans have not been disclosed.

★Clifford J. Murdock, Arizona mine inspector, has issued a new warning to the State's mine operators to comply with the safety rules as prescribed in the State Mining Code. Two miners recently met death in an accident which would not have occurred had safety regulations been obeyed by the operators of the mine. The men were killed by the explosion of a butane gas engine used for pumping water. The engine was located on some timbers about ten feet below the collar of the well which provides for the mining operation. The use of fuel-burning engines underground is forbidden under Arizona laws, and Murdock states anew that violators will be shut down.

UTAH

Utah Copper doubles generating capacity — WAA receiving bids on Salt Lake alumina plant

★The Utah State Supreme Court ruled on Jan. 6 that federal premium metal payments should be included in computing value of mines and smelters for both property tax and mine occupation tax purposes. The State decision follows a United States Supreme Court ruling of March 25, 1946, holding that federal courts were without jurisdiction to hear a case brought by Kennecott Copper Corporation and Silver King Coalition Mines Co. against the Utah State Tax Commis-

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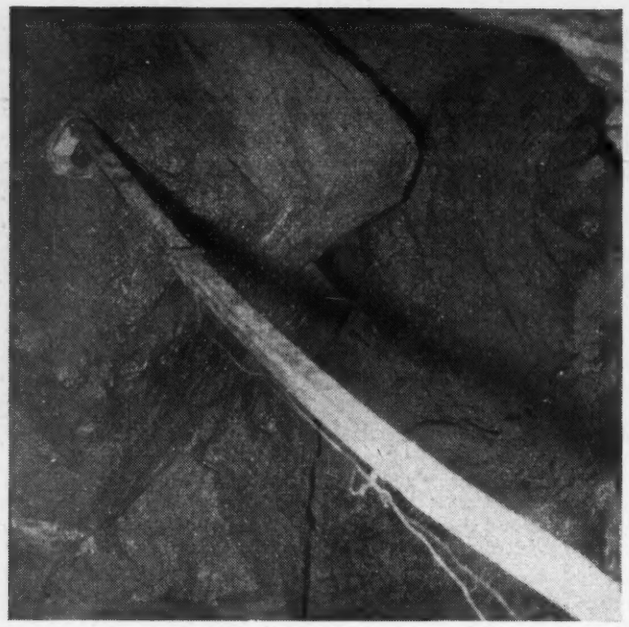
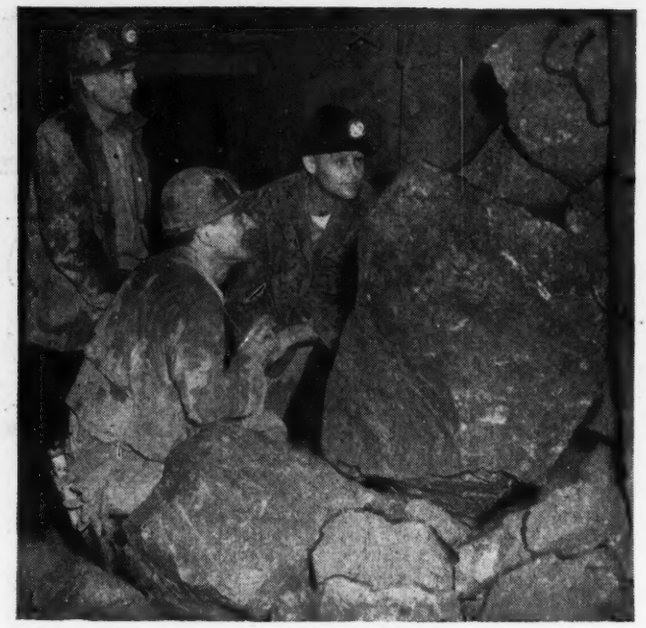


A 13-STICK SHAPED CHARGE is shown in place against a 50-ton garnetized limestone boulder lodged 25 ft. above the collar of a finger raise at National Tunnel & Mines Co., Tooele, Utah. The charge is secured to a 1x4 blasting stick. Crater compound is used to seal and hold the electric cap in place.



THREE 13-STICK SHAPED CHARGES successively cracked, shattered, and brought down the boulder shown at the left, giving a factor of about 3.85 tons broken per pound of explosive. W. T. Warren and Frank Baby, of the National Tunnel & Mines Co. staff, and an explosives company representative view the results.

Utah (*continued*)

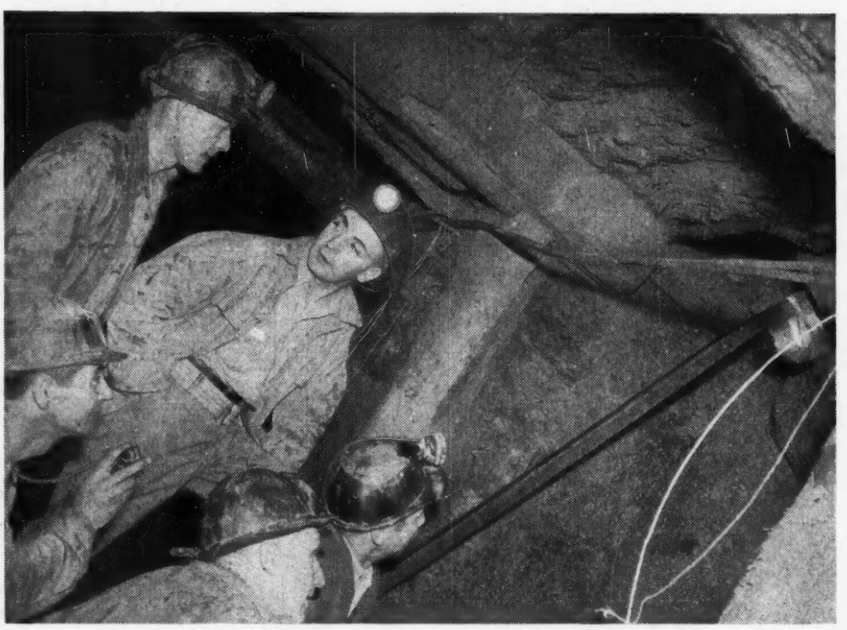
sion to recover mine occupation tax funds based on federal subsidy payments.

Mining companies had contended that the premium payments were awarded by the Federal Government as a bonus for higher production; that they were not part of the sale price or value of ore smelted or sold; and that including them in the determination of gross income was discriminatory.

Justice Lester A. Wade wrote the majority decision of the five-member court upholding the State's right to include the federal payments in computing mine occupation taxes (1% of the gross proceeds of the previous year), involving $163,829 in protested taxes paid by Combined Metals Reduction Co. and ten other mining companies. He wrote:

"It appears that the premium prices paid to the mining companies are for metals sold by them, and since our occupation tax statute provides that the basis for determining the amount of taxes due where there has been a sale of metals under a bona fide contract of sale is the amount of money or its equivalent actually received—from the sale—it is our opinion that the lower court erred in holding that the premium payments received from the Metals Reserve Co. should not have been included by the tax commission in determining the amount due."

★ James W. Wade, president and general manager, Tintic Standard Mining Co., is the new president of the Utah Mining Association, succeeding E. H. Snyder, president and general manager, Combined Metals Reduction Co. Other officers elected are: A. G. Mackenzie, employed by the association for many years, vice president; James Ivers, vice president and general manager, Silver King Coalition Mines Co., second vice-president; W. H. H. Cranmer, president, New Park Mining Co., third vice president; and James K. Richardson, manager.



WITNESSING THE PLACEMENT of a 13-stick hemispherically shaped charge in the mouth of a finger raise at National Tunnel & Mines Co., Tooele, Utah, are, left to right: Frank Baby, foreman; W. T. Warren, general superintendent; Jack Tate, general mines superintendent, Cyprus Mines Corporation; John F. Dugan, general superintendent of mines, International Smelting & Refining Co.; and R. J. Mechin, manager, Edwards Division, St. Joseph Lead Co., Balmat, N. Y.

★ The Salt Lake City plant formerly operated by Kalunite, Inc., for production of alumina from alunite ores mined near Marysvale is being offered for sale by War Assets Administration on a sealed-bid basis. Cut-off date on the bidding was fixed for Feb. 5. Four parcels of mining land near Marysvale, totaling about seven acres, which has been owned by Ka-

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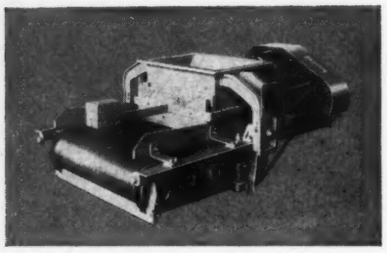

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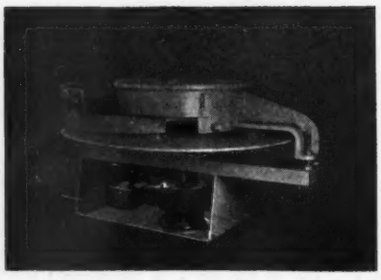

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Utah (*continued*)

lunite, will be sold in a separate offering. During the war 400 persons were employed at the Salt Lake plant, which includes 13 buildings with a total floor space of 82,000 sq.ft. on a 79-acre tract.

★ Effective with the new year, Utah Copper Co. will be known as Kennecott Copper Corporation, Utah Copper division, D. D. Moffat, vice president of Kennecott and president and general manager of the old company, has announced. Utah Copper Co., he explained, was merged with Kennecott in 1936 and since that time has been an operating company under a managerial agreement with Kennecott which ended Dec. 31.

The Utah division, Moffat announced, is adding $3,000,000 worth of equipment to its electrical generating plant at the Arthur mill. Foundations are being placed for two new 25,000-kw. generators and another boiler with auxiliary pumps, which, with other new equipment, will bring total investment in the plant to more than $10,000,000. Present generating capacity is 50,000 kw. The additional generators, bringing capacity to 100,000 kw., will make it one of the largest industrially owned power plants in the West. It is expected that the additional installations will be completed and ready for service some time in 1947.

★ Utah's estimated output of iron ore during 1946 was approximately 1,350,000 gross tons, compared with 1,987,000 tons in 1945. The 1946 figure includes estimates for the last two months and official data for the first ten months. Since the Geneva Steel Co. plant resumed operations at midyear, the average monthly figure has increased to approximately 175,000 tons.

★ Assured iron ore reserves in the Iron Mountain, Granite Mountain, and Twin Peaks region of Iron County probably total 350,000,000 tons, Paul T. Allsman, Chief of the Mining Branch, U. S. Bureau of Mines, Salt Lake City, said at a meeting of the Utah section, American Institute of Mining and Metallurgical Engineers, on Dec. 19. Assumed ore in the same districts brings the potential reserve to 500,000,000 tons, he added, although some of this would have to be recovered by underground methods. Ownership of these reserves is principally by Columbia Steel Co. (U. S. Steel) and Colorado Fuel & Iron Corporation.

★ Valuation of many Utah metal mines will be decreased materially in 1947 due to strikes during the first six months of 1946 which lowered net proceeds upon which the next year's valuations are based. Lifting of ceilings on copper late in the year assisted the Utah Copper division of Kennecott Copper Corporation to attain more nearly to the 1945 net proceeds.

MONTANA

Martin Mining Co. develops ore for shipment—Official discusses Anaconda's outlook

★ Mountain States Clay Products Co., Inc., has been formed to work a bentonite deposit at Vanada, Rosebud County, northwest of Forsyth. It is reported that a mill will be erected and the Milwaukee Railroad will build a spur to the millsite. The operations are expected to employ 20 men. Officers of the company are: W. L. Christian, of Forsyth, president; Gus Hein, of Forsyth, vice president; and David A. Mill, of Lusk, Wyo., secretary-treasurer.

★ U. S. Gold Corporation, incorporated in the State of Washington with capital of $300,000, was authorized to do business in Montana on Dec. 20, 1946. B. E. Holland, City Treasurer of Butte, is the Montana agent, and the company is said to be taking over gold properties in Madison County.

★ Martin Mining Co., with property in the vicinity of the Flathead mine of the Anaconda Copper Mining Co., Flathead County, is developing silver, lead, copper, and zinc ore, and expects to start shipments early in 1947, according to A. R. Johnson, one of the officials of the company. The company office is in Kalispell.

★ Addressing the Butte Exchange Club recently, D. M. Kelly, administrative consultant and retired vice president of Anaconda Copper Mining Co., discussed present and future operations of the company. Production of copper and manganese has increased proportionately since the gradual increase in the working force beginning in July, he said. Zinc production will be resumed at the Anselmo mine in the near future, with 500 men employed under full operation. As manpower becomes available, and if metal demands persist, other mines such as the Lexington, Orphan Girl, and Badger will be reopened. Methods are now being worked out by the company engineers for the mining and treatment of low-grade copper-ore pillars which may contain as much as two billion pounds of copper, Kelly stated. The average daily pay of a Butte miner was cited as $10.32, with contract earnings averaging $12.57.

IDAHO

Polaris completes deepening of Silver Summit shaft—Monitor remodeling Ray Jefferson mill

★ Polaris Mining Co. passed its December dividend because of development expenses and curtailment of production following an underground mine

fire. Current mining operations are on a 50-50 production-sharing basis with Sunshine Mining Co. from what is known as the "Omega" area, which is reached only through Sunshine deep workings. Separate from this area, Polaris has completed sinking of the Silver Summit shaft to the 3,000-ft. level, establishing a speed record for the Coeur d'Alene district. A total of 1,565 ft. was completed in 11 months and 8 days, averaging approximately 142 ft. per month. This speed was made possible by the use of a Riddell mucking machine.

Polaris deepened this shaft for the purpose of developing the "Chester" vein system, which contains high-grade orebodies on properties owned by Polaris, Silver Dollar, and Silver Syndicate Mining companies, all of which are producing on the 2,500, 2,700, 3,000, and 3,700 levels in the Sunshine mine workings. Polaris will open this vein system on the 3,000 ft. level, and, in addition, will prospect several other veins, including the Silver Summit and Merger Mines veins.

★ Monitor Mining Co. has remodeled the Ray Jefferson mill, in the Beaver Creek district north of Wallace, where all ores from the various Monitor workings will hereafter be treated. These ores have heretofore necessitated a long haul over steep mountain roads to treatment plants in Wallace. Among other properties recently purchased by the company is the old Inter-State Callahan mine, a large zinc producer during the first World War. Deep workings of this mine have now been connected to the Monitor's underground network.

★ Dan Murphy, part owner and manager of the Oro Fino mine, in the Murray district, has installed a large-capacity Ingersoll-Rand air compressor, replacing a lighter machine of the same type, in driving a crosscut tunnel, some 800 ft. in length, to open a zinc-lead vein from which intermittent shipments of both crude and milling ore have been made. The milling ore has been shipped to the Hercules mill, in Wallace. Murphy now plans to ship this ore to a custom mill being established in the Murray district. He estimates the Oro Fino will furnish about 50 tons of mill-grade ore per day.

★ Sunshine Mining Company has started raising in the Yankee Girl vein from the 3,100 level. So far the work is in good ore. An assay from 20 cars of the mine-run muck gave returns of 46.7 oz. silver per ton. Drifting on the 3,100 level has opened the vein for a distance of more than 700 ft. in ore averaging 20 oz.

★ Silverton Mines Co., on Revenue Gulch west of Wallace, has started sinking a shaft with the first objective at 1,000 ft. The company has erected mine buildings, constructed roads and equipped and electrified the property for deep development after a considerable outlay on diamond drilling.

★ Lucky Friday Silver-Lead Mining

SuperDuty

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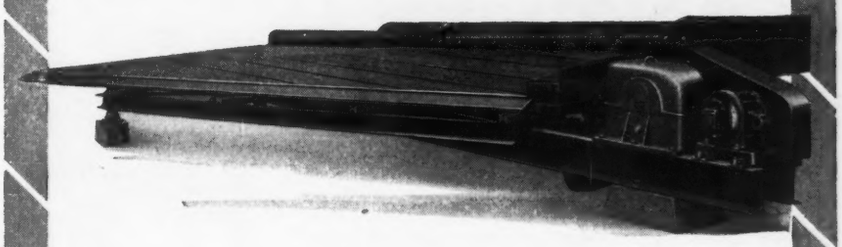

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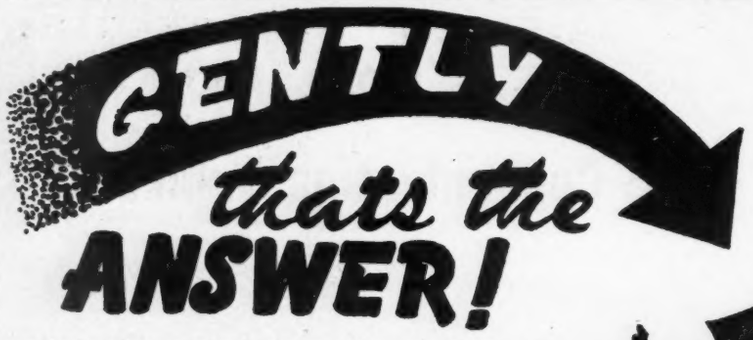

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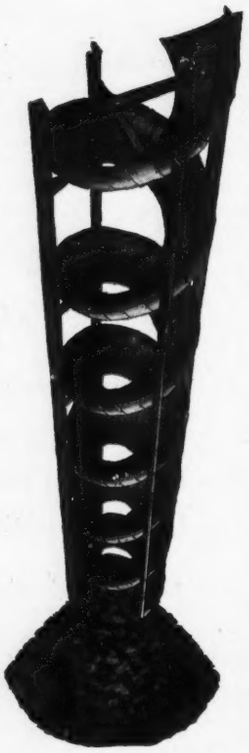

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DANVILLE, ILLINOIS

Idaho *(continued)*

Co. has shipped its first ore from development work on the 1,400-ft. level. The ore was sent to the Golconda custom mill and consisted of about 1,000 tons, which concentrated down to 93½ tons of lead and 27 tons of zinc. The lead was sent to the East Helena smelter and netted returns of $21,926.15. The zinc concentrate went to the Sullivan zinc plant and netted $1,389.98, giving a total return of $23,316.13. On this lower level the vein shows great improvement. Drifting has disclosed a major-sized orebody for a length of 450 ft. east of the shaft. The vein is also well defined, with stringers of ore for an equal distance west of the shaft.

★ Idaho has valuable deposits of diatomaceous earth, according to Paul C. Henshaw, acting head of the geological department of the University of Idaho. During the past year Dr. Henshaw and Harold A. Powers spent six weeks examining the major known deposits of this material in southwestern Idaho, between Weiser and Twin Falls, and reported a number of commercial deposits in 25 localities examined.

★ Leverett Davis has applied to the State Land Board for a 10-year lease on a 10-mile long strip of the Boise River, extending downstream from the Arrowrock dam, presumably for placer operations. Before granting the lease the board is studying the effects of gold-dredging operations on irrigation projects. Davis is an engineer for the Callahan Zinc-Lead Mining Co.

★ Highland-Surprise Mining Co., on Pine Creek, has completed its operating shaft to a depth of 900 ft., according to Frank H. Mitchell, mine superintendent. Production from the 800 level, he reports, has been at the rate of 90 tons every 24 hours for the past 11 months, the total reaching 26,502 tons, with an average gross value of $12.10 per ton. The average net value was $1.86 and the total net, before deductions, was $49,226.36.

WASHINGTON

Bids tendered for ferrosilicon and magnesium plants—First Thought reconstructs mill

★Bids of $8,000,000 and $6,561,400 were submitted to the War Assets Administration Jan. 6 for the magnesium plant at Mead and the ferrosilicon plant at Rock Island. American Chrome & Magnesium Industries, Inc., of New York, was the high bidder. The other bid was tendered by Morley & Associates, of Seattle. The final award will be made by WAA officials in Washington, D. C. The American Chrome company has plans for making magnesium, chrome alloys, chrome-chemical, and magnesium-chrome refractory bricks, using

ores from its Twin Sisters Mountain properties in Whatcom and Skagit counties, and would coordinate the project with the Mount chrome mine, in Montana, according to Alwyn H. Wild, president. It would employ about 5,000 persons in the Mead and Rock Island plants and about the same number in mining and metal development.

The Morley company plans to produce magnesium reels and to add a foundry with a capacity of 2,000,000 lb. of magnesium castings a month, according to James C. Morley, president. The new magnesium reel would be for use in the wire rope and electric wire and cable industries. A. L. Atherton, vice president of the Morley company, was recently elected vice president of American Chrome & Magnesium as a step in consolidating the interests of the two firms.

The ore reserves of the Twin Sisters properties will produce a minimum of 95,000,000 tons of magnesium metal on a 75% recovery basis, according to estimates. High-grade chrome concentrates can be produced from the large bodies of chrome ore on the properties and can be converted into chrome chemicals, chrome bricks, or ferrochrome, according to Wild.

★Trustees of Northwest Mining Association plan to give wide publicity to the address of R. W. Diamond, manager of Consolidated Mining & Smelting Co., Ltd., of Canada, given at the December meeting in Spokane, in which he said that the maintenance of a stable society was the first concern of the mining industry. Extracts from the address are being printed for general circulation.

★The 20th Annual Mining Institute of the College of Mines was held Jan. 16, at the University of Washington. Addresses, motion pictures, and demonstrations of modern mining techniques and of new equipment were given. The prospectors' course, open to men past high-school age, began on Jan. 6 and will run through March 20. It will include instruction in chemistry, geology, handling of ores and minerals, field trips, and practice with milling equipment and prospect mining, Dean Roberts said.

★A shipment of 35,000 lb. of silver wire from the Velox depot, west of Spokane, went to the Tacoma plant of the American Smelting & Refining Co. late in December. The shipment of 290 boxes contained about 40% silver. The wire will be reduced to its component elements. It was purchased as surplus government property.

★According to J. R. Meek, works manager at Trentwood, the Kaiser aluminum plants at Spokane were limited in December to about 75 percent capacity due to lack of soda ash. The Tacoma plant adds about 3,320,000 lb. of aluminum pig capacity per month to 18,000,000 lb. capacity at Mead. The goal for the Northwest plants is 24,000,000 lb. monthly. Meek

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Washington *(continued)*

stated that the bauxite deposits in Oregon and Washington are too low-grade to be used in the Northwest's aluminum industry. The Spokane plants purchased $240,000 worth of prepared airplane scrap from the Seattle office of WAA in December.

★The mill of the First Thought mine, at Orient, is being reconstructed, according to R. E. Rudd, vice president of the company. Primary and secondary crushing equipment will be installed.

NEW MEXICO

Metal production in 1946 falls below previous year — Carlisle mines remain closed

★ Metal production from New Mexico during 1946 totaled 3,968 oz gold, 328,000 oz. silver, 100,426,000 lb. copper, 10,024,000 lb. lead, and 72,726,000 lb. zinc, according to preliminary figures released by the U. S. Bureau of Mines. This compares with 5,604 oz. gold, 465,127 oz. silver, 113,142,000 lb. copper, 15,324,000 lb. lead, and 80,590,000 lb. zinc produced in 1945.

The drop in gold, silver, lead and zinc output resulted mainly from a three months' strike at the Hanover unit of American Smelting & Refining Co. and the closing down in June of the Carlisle group of mines owned by Exploration Syndicate, Inc. Loss of three months' production at the Burro Mountain property of Phelps Dodge Corporation combined with smaller output from Kennecott's Chino operations to reduce total copper production.

★ Banner Mining Co. operated its Bonny and Miners Chest copper properties and 500-ton flotation plant, in Hidalgo County, throughout 1946.

★ Moline Mining & Milling Co. treated zinc-lead ores from its Santa Fe County properties intermittently during 1946. The company operates a 35-ton selective flotation mill.

★ The Magdalena unit and 200-ton flotation plant of American Smelting & Refining Co., in Socorro County, operated throughout 1946. Zinc-lead ore was shipped by McDonald & Dobson from the Nitt properties, also in Socorro County.

★ Peru Mining Co. operated its Pewabic, Copper Flat, and Kerany mines in the Central district, Grant County, throughout 1946. Lead and zinc ores were treated at the company's 1,000-ton selective flotation mill at Wemple.

★ Operating several mines in the Central district under the name, "Bayard Mine," United States Smelting, Refining & Mining Co. was the leading producer of lead and zinc in the State in 1946.

TRI-STATE

Portal-to-Portal suits are filed — American Development reopens Consolidated No. 3 shaft

★ Thirteen major Tri-State mining companies were named defendants in suits filed the last week in 1946 in federal district courts at Joplin and Tulsa, Okla., for $27,960,000 in portal-to-portal pay and damages under the Fair Labor Standards Act: The suits were brought by representatives of the International Union of Mine, Mill and Smelter Workers (CIO) in behalf of an estimated 11,100 miners. The defendant companies are: Eagle-Picher Mining & Smelting Co.; Rialto Mining Corporation; St. Louis Smelting & Refining Co.; Federal Mining & Smelting Co.; Kansas Explorations, Inc.; F. W. Evans; Cameron & Henderson, Inc.; Scott Mining Co.; Cardin Mining & Milling Corporation; Marcia K. Mining Co.; Lawyers Lead & Zinc Co.; Davis-Big Chief Mining Co.; and Beck Mining Co.

As in similar suits filed by the CIO in industrial centers over the country, the petitioners contend the workers are entitled to overtime pay at time and one-half for all time spent on company premises in getting to and from work. In the case of the miners, they seek back pay for "dressing time" and lunch time, and for time spent making extra trips to offices for pay checks and to clinics for medical examinations.

In all the petitions the plaintiffs seek judgments in "liquidated damages" for the individual workers in amounts equal to the claimed back wages for all time worked in excess of 40 hours a week back to 1938. The union officials also state that neither the miners nor the union has records showing the exact amounts of overtime worked by each employee, or the wages still due, and requests the court to require the companies to answer a list of interrogatories attached to the petitions, supplying the data from company records. Permission also is asked to permit the union officials to amend the petitions later to change the amounts of damages asked, and to add additional names of employees to the lists of claimants.

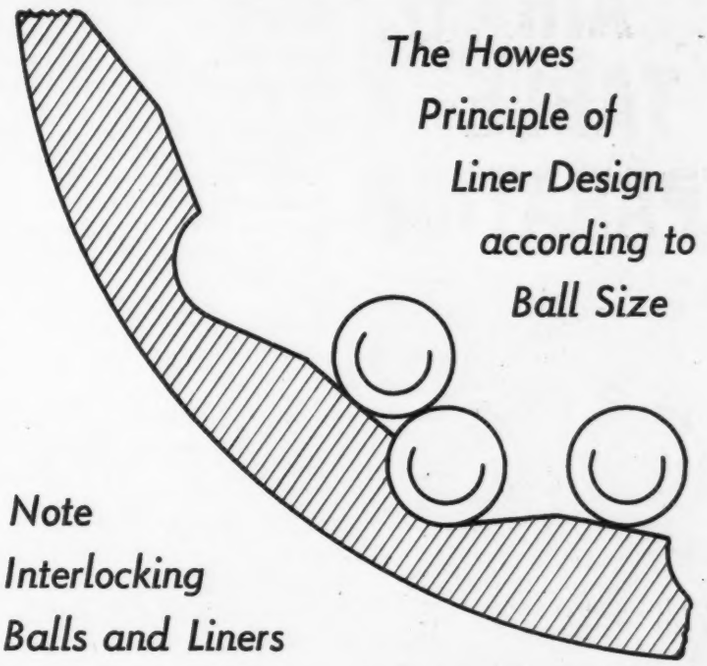
★ A working contract between the Eagle-Picher Mining & Smelting Co. and Local No. 861, International Union of Mine, Mill & Smelter Workers (CIO), composed of Tri-State employees of the company, was signed on Dec. 5 at the Cardin field offices of the company after several weeks of negotiations. The contract affects 1,200 employees. The action ended the possibility of a strike by the union, which had been approved by the membership in a secret referential strike ballot on Nov. 1. The contract provided for a general wage increase of 48c. a day, with many classifications

receiving from 5c. to 50c. additional per diem. It was agreed the company would continue on a six-day work week basis, and if the operations should revert to a five-day week, the wage question could be reopened. Otherwise, the wage issue could be reopened every 90 days on 10 days' notice on the part of the company or union. An application has been made jointly by the company and the union to the quota committee on the Premium Price Plan for copper, lead, and zinc in Washington for a six-cent-an-hour adjustment of retroactive pay involving the employees for an eight-month period. Other principal provisions for the contract, which will expire June 30, 1947, called for union maintenance of membership; check-off for union dues, initiation fees, fines, and assessments if any; an elaborate seniority system, including general grievance procedure; time and one-half for over eight hours work; shift differential of four cents for evening and eight cents for night shift; seven holidays with time and one-half if worked; one week's vacation with pay for a year's employment and two weeks for five years of continuous service; and an employees' sick fund, in which the company advances a dollar per employee to be administered jointly by the company and union.

★ An informal program of brief talks by several speakers featured a joint dinner meeting of the Tri-State section, American Institute of Mining & Metallurgical Engineers, and district Missouri School of Mines and Metallurgy alumni, held on Dec. 6 at the Connor Hotel, in Joplin. The occasion was in honor of 53 student members of the senior mining class of the Rolla school, who had spent four days in the Tri-State on a field trip inspecting mining, milling, smelting, quarrying, and related industries throughout the district.

★ Officers of the A.I.M.E. Tri-State section for 1947 were chosen Jan. 3 at a meeting of the newly elected board of directors held in Picher. O. W. Bilharz, Baxter Springs mine operator, was named chairman of the local section.

★ An airborne survey of the Tri-State mining field was conducted during December by a U. S. Geological Survey party headed by Fred Keller, survey geophysicist in charge. The three-day experimental survey, designed to add some information as to the mode of occurrence of lead-zinc ores and general geological formation of the area, covered some 1,500 flight-line miles, Keller said. A twin-engine Beechcraft (AT 11) bomber trainer, equipped with magnetometer and other special devices and owned by the Survey, was used. The area covered was outlined to the party by George M. Fowler, Joplin consulting geologist. In general it included the area west of Carthage to Melrose, Kan., and from West Mineral on the north to Miami on the south—approximately



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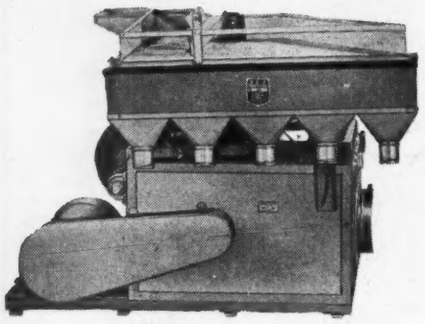

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Tri-State (*continued*)

1,000 square miles of total area.

★ A 500-ton hopper and steel derrick has been moved by the St. Louis Smelting & Refining Co. to the old No. 8 shaft on the Hartley lease, just north of the Ballard property southwest of Baxter Springs, according to S. S. Sandusky, superintendent. The hopper and derrick were moved from the No. 27 shaft of the company on the Bailey lease.

★ American Development Co. has reopened the old Consolidated No. 3 mill shaft in the northeast part of Picher, according to W. T. Landrum, of Baxter Springs, who is associated with Dewey Sims, of Miami, in the enterprise. Mine operations are being carried on at the 230-ft. level and ore is being shipped to the Eagle-Picher Central mill.

ARKANSAS

Magnet Cove molybdenum deposit is diamond-drilled—U.S.G.S. flies magnetometer survey

★ The U. S. Geological Survey recently conducted an airborne magnetometer survey of the highly magnetic Magnet Cove area in Hot Spring County. The crew consisted of two geophysicists and a pilot and co-pilot. Fred Keller was the geophysicist in charge. The survey covered an area of 30 square miles and required 2 hours, and 10 minutes' flying time. Drew Holbrook, assistant geologist of the Arkansas Geological Department, was an observer on the aerial survey.

★ The M & M Exploration Corporation, of Little Rock, is continuing diamond core-drill exploration work on the Golden-Estes molybdenum deposit in the Magnet Cove district, Hot Spring County. This work was started the first of December for the Mo-Ti Corporation. W. W. Sheldon, of Hot Spring, is president of the company.

★ The Strategic Minerals Production Co. has recently been incorporated in the State. The company plans to operate a zinc mine known as Mine 16, in Marion County, Ark. Paul Turney is the engineer in charge.

★ Diamond Corporation of America, engaged in diamond mining in Pike County, was named in a complaint filed in chancery court at Little Rock by Glenn Martin, Baltimore aircraft manufacturer, charging mismanagement. Martin, who is said to have invested $400,000 in the project, claims that the corporation failed to acquire equipment or commence mining operations within the time called for under its lease. The corporation has entered a cross-complaint in which it alleges that Martin, failing to secure control, sought to bankrupt the organization, and asks damages of $2,000,000.

ILLINOIS and KENTUCKY

Ozark-Mahoning Co. purchases Delhi-Babb fluorspar mine

★ The Ozark-Mahoning Co. announced purchase in December of the Delhi-Babb fluorspar mine from the Delhi Fluorspar Corporation, of which Claude A. Fletcher, of Marion, Ky., is president. The property is two miles north of Salem, in Livingston County, Ky. Operation of the mine is in progress, and the ore, including some zinc and lead as well as fluorspar, is being hauled to the Ozark-Mahoning fluorspar-lead-zinc flotation mill at Rosiclare, Ill. The Delhi-Babb property has been developed by Ozark-Mahoning under lease for the last year.

★ The Aluminum Ore Co., Fluorspar Division, of Rosiclare, Ill., has taken options on the Lovelace fluorspar properties and two adjoining tracts in Livingston County, Ky. The Lovelace property has been held in perpetual lease by the Lovelace Mining Corporation, of Evansville, Ind. Drilling on the newly leased property is held in abeyance, pending completion of road construction in that area. At present drilling is under way on properties recently purchased by Aluminum Ore from the Eagle Fluorspar Co., also operating in Livingston County.

NORTH CAROLINA

Minerals research laboratory is established—New company will exploit vermiculite deposits

★ North Carolina State College has opened a minerals research laboratory at Asheville to fill a grave need for basic and applied mineral-dressing research on non-metallic minerals of the region, according to Jasper L. Stuckey, State Geologist. L. L. McMurray, chief engineer at the laboratory, will be assisted by five engineers and technicians.

The new laboratory will devote particular attention to flotation concentration of minerals. Other fields of research will include jigging, tabling, hydroseparation, and Heavy Media. The laboratory is also being equipped to do research in magnetic separation, differential crushing and grinding, as well as processes requiring heating. Allied investigations such as microscopic work, screening, grinding, size classification, dewatering, and drying will be carried out.

Plans have been formulated whereby the laboratory can offer technical services related to the mineral industry in general. These include maintaining at the laboratory files of equipment catalogs required for mining and ore dressing, complete market reports,

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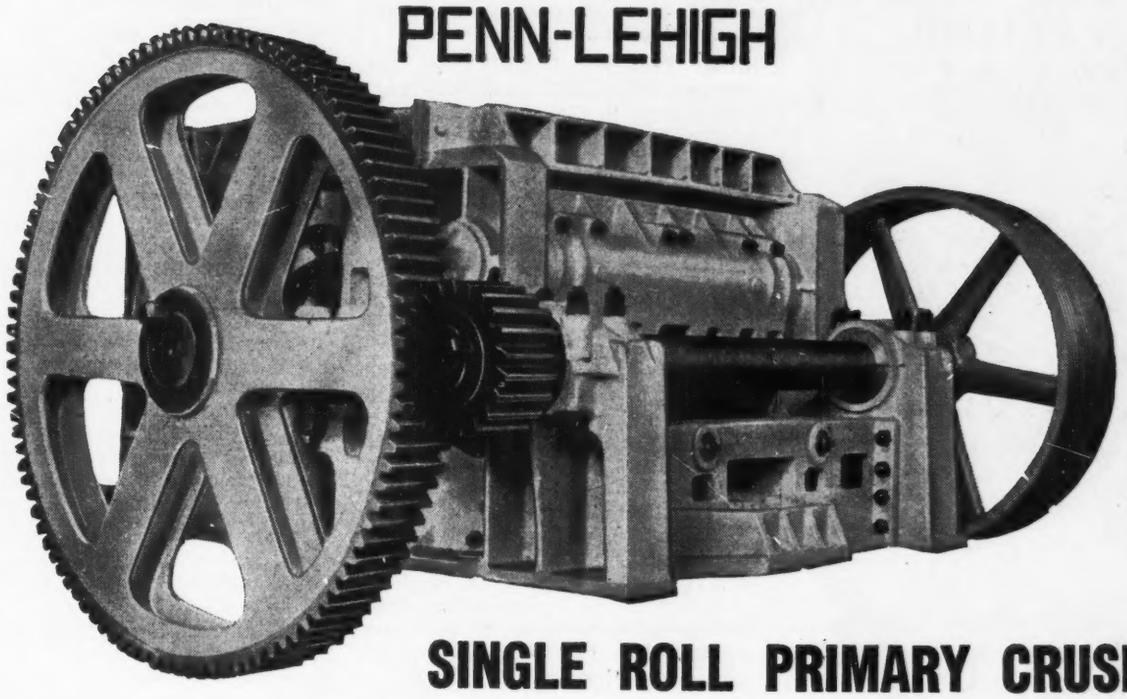

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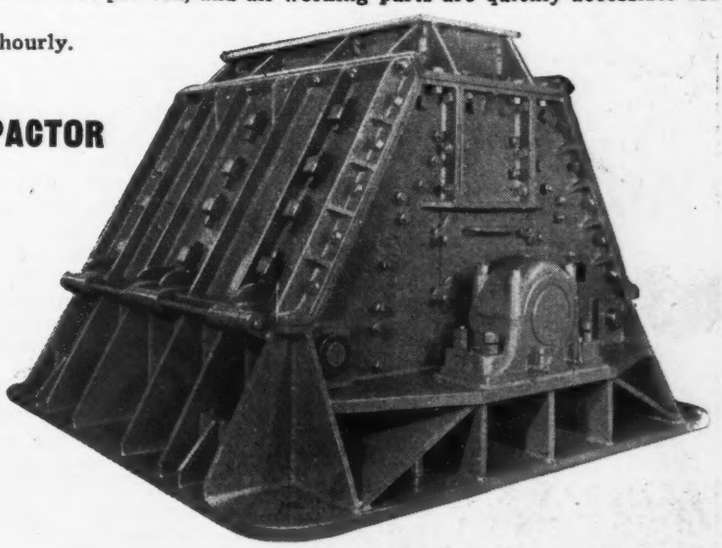

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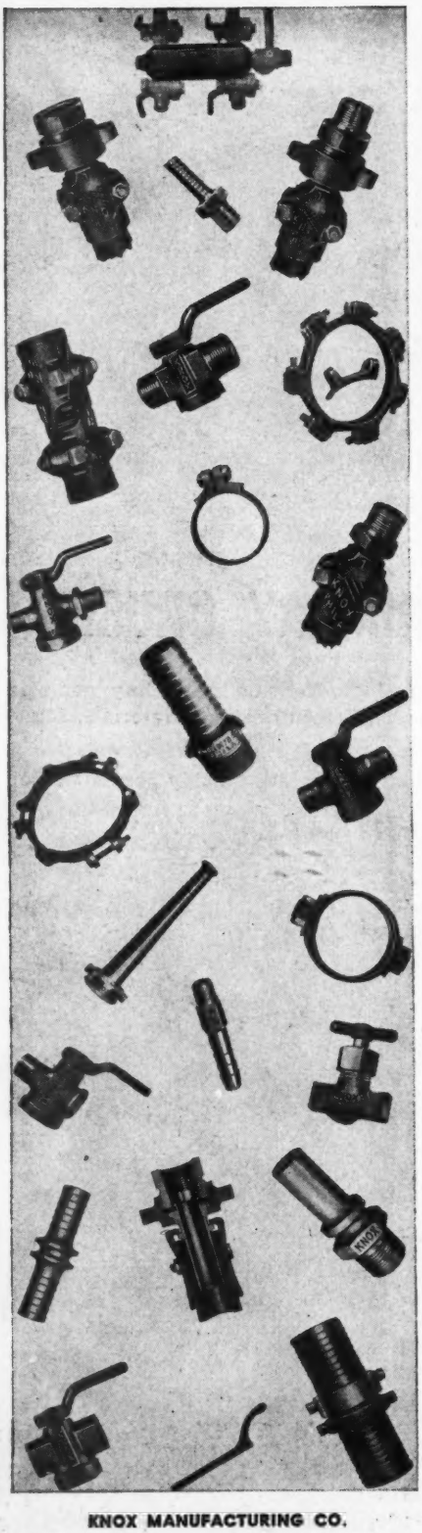

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North Carolina *(continued)*

technical books and literature, professional papers dealing with minerals of the area, and a collection of minerals and ores of the area to serve as a basis of comparison and evaluation of new deposits.

★ Bee Tree Vermiculite Mines, Inc., was organized at Asheville on Jan. 3 with George B. Coggins, who has subscribed half the stock, as president. Authorized capitalization is $100,000. Howard I. Young, president of American Zinc, Lead & Smelting Co., which subscribed the remainder of the stock, was named chairman of the board of the new company. Ralph P. Immel, vice president of American Limestone Co., of Mascot, will serve as vice president and treasurer.

In addition to operating the mines and plant of Bee Tree Vermiculite, at Tigerville, S. C., formerly owned by Coggins, the company owns extensive vermiculite deposits in the Piedmont area of South Carolina. Coggins states that it plans additional plants in the South and East, and will establish sales outlets throughout the South. Research engineers will be employed to work with the North Carolina State College minerals research laboratory, at Asheville, and with engineering schools and Government agencies.

Tennessee Copper Co. Output up to Capacity

Tennessee Copper Co. has received delivery of the first of two American Locomotive-General Electric 650-hp. diesel electric terminal engines for switching. The second engine is expected to be delivered within another month.

The company has closed down its last copper blast furnace, which had been in use since 1901. All processing is now through the roasters, the capacity of which has been increased by the installation of two 30,000-cfm. fans.

Mine operations are now at capacity of the processing plants, and it is expected that present production levels will continue for some time. Practically the entire output is going into copper sulphate for fungicides, for which there is now a great demand. The company plans considerable research in fungicides.

A consolidated research laboratory is to be established at College Park, Ga., with J. K. Plummer in charge. The research laboratory, now operated by Tennessee Corporation, will be moved to the consolidated laboratory. A number of the company's chemists will be transferred to the new establishment. The work will be such as to broaden the market for the company's products and develop new products.

A recent survey of the company safety record revealed that the lead burners and helpers have completed a 20-year safety record without a lost-time accident in 1,711,181 man-hours.

MICHIGAN

C. & H. president views outlook for 1947 optimistically

★ E. R. Lovell, president of Calumet & Hecla Consolidated Copper Co., in a recent statement to employees, expressed confidence that 1947 would bring better times. He said, in part:

"In spite of serious handicaps during 1946, the Calumet and Wolverine divisions of our company made good showings. In contrast with the industrial picture throughout the rest of the nation, our labor relations remained excellent, efficiency improved in many operations, and, in general, a better understanding was effected between employees and management. . . . Competition during 1947 will become increasingly severe. However, if we continue to work together as a loyal team, if we tirelessly continue to improve production methods and reduce costs, we should have no fear of the future."

★ A dividend bonus totaling approximately $26,500 was distributed to the employees of the Calumet division of Calumet & Hecla Consolidated on Dec. 21. Each employee received $12.50, equivalent to 25c. per share on 50 shares of stock. This profit-sharing plan was started in 1936, and the first bonus, also $12.50 for each employee, was paid on Oct. 31 of that year. Since the inception of the plan, dividend bonuses totaling $375 have been paid to each eligible employee.

IRON COUNTRY

New vertical shaft to replace incline at Book—Vibrators reduce dock unloading time

★ A fire which started on Dec. 17 on the 33rd level of the Montreal mine, near Hurley, Wis., on the Gogebic Range, caused removal of the men after gases developed. Work was not resumed until Dec. 23. The cause appeared to be a power-cable short-circuit near a timber set in a loading drift. It was quickly extinguished, but the men were kept out until the ventilation system had cleared all workings.

★ At a meeting of the Marquette Range Engineers' Club at Ishpeming, Mich., on Dec. 17 new officers were elected for 1947 as follows: Clyde DeHass, Marquette, president; Harry Peterson, Ishpeming, vice-presidents; Frank Masek, Ishpeming, treasurer; Peter Ribotto, Ishpeming, secretary.

★ Preparations are under way to sink a vertical shaft 350 ft. deep to replace the incline shaft used last season at the Book mine, on the Menominee Range, near Crystal Falls. Only direct-

shipping ore is mined through the shaft. Concentrates are secured from low-grade stockpile ore accumulated while the mine was being stripped. A total of 116,798 tons was shipped last season.

★ The Cornell mine of Globe Iron Mining Co., near Iron Mountain, Mich., continued its small open-pit operation in 1946, but instead of shipping all-rail as in previous seasons the ore went by water. A total of 27,181 tons was shipped to the company's plant at Jackson, Ohio.

★ An interesting experiment is being carried out on the Northwestern dock at Escanaba, Mich., to remove iron ore from the cars. The old system required four men to prod the ore with long poles or bars until the car was cleaned—a slow process. With the new system a pair of Syntron electric vibrators is attached to the car, one on each side close to the discharge opening. They transmit 3,600 strokes per minute with sufficient vibration of the side plates to loosen the sticky ore, and the car is unloaded in half the time required by four men. The problem now is whether to equip each of the 3,000 ore cars with vibrators or install brackets and move the vibrators from car to car. More testing is needed before a decision can be reached.

★ A moot subject of discussion among Lake Superior operators at present is the portal-to-portal pay the mines must hand over if the United Steelworkers' union wins its Federal Court suits. The lowest estimate on costs exceeds two million dollars and is based on the assumption that each miner would get about $3 per week back pay dating from 1938. This sum could be substantially increased by the court's interpretation of existing contracts.

★ Stripping operations are under way at many of the mines in the Hibbing district of the Mesabi Range. At the South Agnew mine, Butler Brothers are busy relocating roads, and railroad and drainage plans have been completed. Stripping at the Weggum mine, east of Hibbing, has been discontinued until April 1. Butler Brothers' South Agnew mine expects delivery of the conveyor construction material about Feb. 1. The portable screening plant and the large dragline will be delivered early in the spring. Tony Reisinger has been named pit foreman in charge of the South Agnew mine.

★ Ore reserves in Minnesota have dropped below the billion-ton mark for the first time. War demands from 1941 to 1946 depleted Minnesota's iron-ore reserves an average of 36,000,000 tons annually, G. Howard Spaeth, State Commissioner of Taxation, disclosed recently. Reserves as of May 1, 1946, were 995,488,000 tons with a total assessed mineral value of $120,344,635. St. Louis County has 781,399,000 tons, with an assessed value of $109,217,736; Itasca County, 155,027,-

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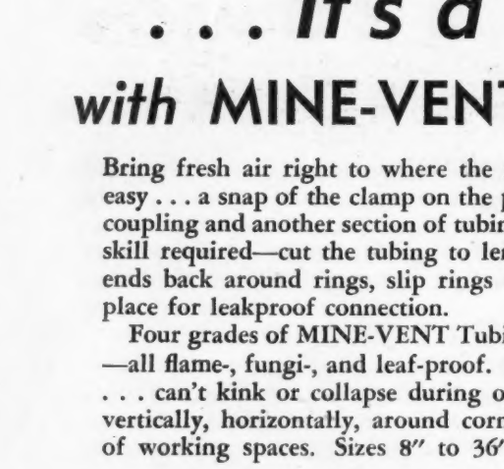

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Iron Country *(continued)*

000 tons, assessed value $9,353,581; and Crow Wing County, 59,062,000 tons, valued at $1,733,318. Mr. Spaeth explained that unmined ore is assessed at 50% of its full and true value in the ground.

★ Employees of the International Harvester Co. at the Agnew mine, at Hibbing; the Sargent mine, at Keewatin; and the Hawkins mine, at Nashwauk, are still out on strike. Despite offers of arbitration by civic bodies, the dispute has been a hard one to compromise.

ALASKA

New discoveries made in Copper River area—U.S.G.S. reports on copper-bearing deposits

★ Charles J. Johnston, president, told the Alaska Miners' Association at its meeting in Seattle, in December, that he believed nearly every Alaska gold miner is opposed to the theory of the gross tax on gold production. He said such a tax on an industry struggling to reestablish itself is unfair, and that the mining industry's chief hope now is for a higher price of gold, although it is fearful it will not be realized. Norman C. Stines spoke of the hardships experienced by the Alaska Juneau company under the gross tax. He said a severance tax has been proposed which would add to the burden of the industry and would not be workable. H. L. Faulkner, attorney, of Juneau, told of difficulties encountered by miners working stream beds, and suggested that Delegate Bartlett would introduce in the next session of Congress a bill to remedy conditions in mining the beds of Alaska's navigable streams.

★ Riverside tungsten mine, near Hyder, during 1946 shipped more than 200 tons of lead concentrates to the smelter at Tacoma, Wash., according to J. H. Scott, of San Francisco, operator of the mine.

★ New discoveries of gold and copper were reported in the Copper River country by Robert S. Sanford, regional director of the Bureau of Mines, on his return to Fairbanks. Copper outcrops on Dry Creek have been located by Steve Worbel and George Smith. Alaska Pacific Gold Mining Co., with Phil Holdsworth in charge, has a crew of 26 men doing development work underground at the Independence mine, and a crew of 14 improving the mill and camp site. Gold Cord Development Co. is employing one shift at its mill, in the Willow Creek area, with A. L. Renshaw in charge. Underground development will continue through the winter. Snowbird Mining Co. has installed an aerial tramway at its property, and development work

will continue throughout the winter.

★ William E. Wrather, Director of the Geological Survey, announces that L. A. Warner, G. M. Flint, Jr., and R. G. Ray have made an investigation described in a report entitled "Copper Deposits at the Rush and Brown Mine and Venus Prospect on Prince of Wales Island, Southeastern Alaska." The deposits are situated near the head of Kasaan Bay, 45 miles northwest of Ketchikan. Veins are found containing chiefly pyrite, chalcopyrite, and pyrrhotite. Small deposits of copper-bearing magnetite occur, and one large deposit has been mined for its copper at the Rush and Brown property. At the Venus prospect a vein of pyrrhotite with sphalerite, pyrite, and chalcopyrite, has been uncovered, and 8,000 tons containing a little copper, zinc, silver, and gold are indicated.

CANADA

Labor situation still clouded—Favorable developments at Red Lake mines—Hudson Bay adds to power facilities

★ The strike at the Noranda mine entered its tenth week on Jan. 24 with no indication of reaching a settlement. Union membership is claimed for less than half the 1,000 workers at this important copper-gold producer, where demands are being made for a union checkoff and a pay increase of 16c. an hour. The company is refusing the checkoff and offers a 10c. increase in wages, which has been put into effect with all non-union employees. Strikers have been receiving from miners in the Porcupine district a fund made up of the 10c. an hour higher wages recently granted them. The checkoff is stated to be the main issue in the Noranda strike.

★ The mine labor picture in Ontario has not yet been clarified, following the pay increase of 10c. an hour generally adopted by the mines early in December. At Hollinger and other mines the union is attempting to get wages advanced 16c. The Ontario Labor Board has reserved decision in petitions from the CIO local affecting men at the Wright-Hargreaves, Omega, Sylvanite, and Chesterville mines. The Labor Board refused the union application covering Teck-Hughes, where a contract with an independent union continued in effect. At Dome Mines, the CIO withdrew its application for certification after failing to gain adequate representation.

★ Dividends paid in 1946 by Canadian mines amounted to $77,379,000, compared with $75,650,000 in 1945 and $108,561,000, the record high, in 1941, The Northern Miner reports. Base-metal producers increased dividends last year to $57,049,000; payments by gold mines declined to $18,705,000.

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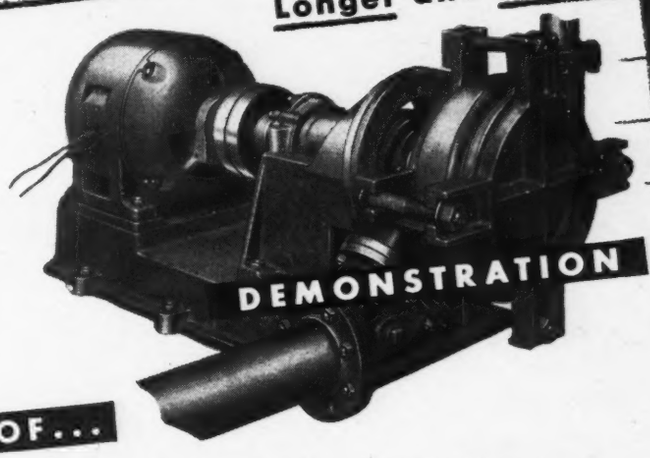

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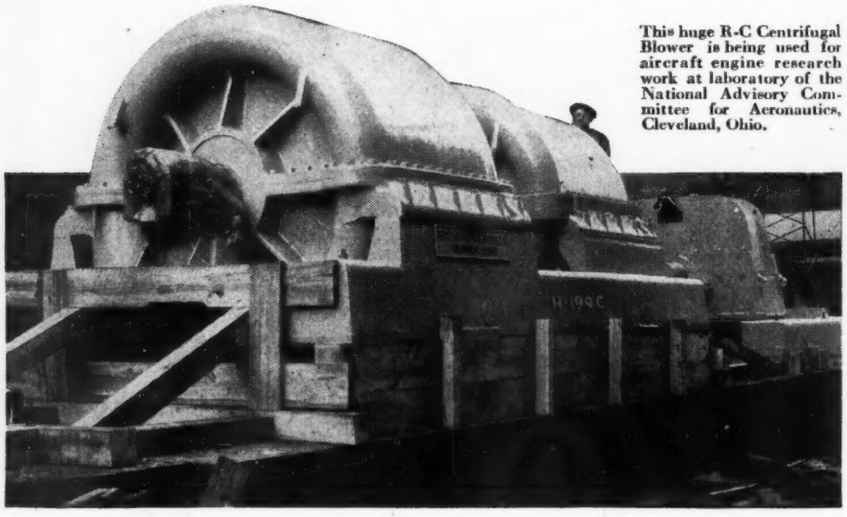

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Canada (*continued*)

★ Canada's mineral production in 1946 was valued at $508,872,631, compared with $498,755,181 in 1945, as reported by the Dominion Bureau of Statistics. Gains were shown for fuels, non-metallics, and structural materials. The value of metals declined more than $12,000,000 and the drop in volume was much greater. An increase in quantity was shown for gold, iron ore, lead, bismuth, cadmium, calcium, selenium, tellurium, and tin, which came up from 516,626 lb. in 1944 to 874,000 lb. Asbestos and gypsum showed important gains over the records for the previous two years. Lead production broke all records for value but fell short of the tonnage for 1942. Zinc, though lower in volume, reached an all-time peak value. Silver was lower in quantity than for any year since 1906 but reached the highest value since 1935. Mineral production attained its record level of $566,768,672 in 1942.

★ Mines Minister Glen stated on Jan. 7 that for several days the Cabinet at Ottawa had been considering "a better financial break" for the gold-mining industry. A brief presented by delegates from the northwestern Quebec mining town of Malartic recommended that the government (1) investigate all forms of taxation which tend to increase mining costs; (2) allow tax exemption of 50c. a ton for low-grade ore; (3) subsidize low-grade gold producers; (4) grant miners the same income-tax privileges given workers with seasonal employment. The Government's attitude on these proposals was not made known.

QUEBEC

★ George W. Robinson, manager at Stadacona Mines (1944), has reported opening a new oreshoot between the 2,325 and 2,025 levels, with a possibility of extending up to the 1,125-ft. level. Lengths up to 106 ft. had been shown by development, the widths ranging from 6 to 7.7 ft. and the grade from $4.97 to $9.69 per ton. Work on the lowest levels has indicated a grade better than mine average, which in 1945 was $6.63 a ton. Recent drifting on the 2,475 level indicated increased length for a new oreshoot that was first picked up on the 2,325 level. Ore lengths developed in the main shear on the 2,325 level total more than 900 ft. Work has not yet started on the bottom level at 2,625 ft. and exploration is just starting on the 2,475 level. On upper levels the mine averaged 750 tons of ore per vertical foot, but the average at depth now appears to be better than 900 tons per foot. W. B. Maxwell is president.

★ Lamaque Gold Mines has reported severe effects on tonnage as a result of labor shortage. The average treated by the 1,250-ton mill dropped from 438 tons a day in 1945 to a low of 320 to 340 tons in recent months. The

mine is opened to a depth of 3,600 ft., but reduced working crews in recent years led to a policy of drawing mill feed only from above the 1,800-ft. level. The mine is being prepared for a higher mill rate by installing an underground crusher below the 2,300-ft. level, by enlarging haulageways, and by expanding chutes for the ore-pass system. Stope preparation is well advanced in the "A" zone, which contains upward of 1,500,000 tons averaging $6.56 in gold per ton. The "A" zone is 500 ft. in length and extends from the 1,800 horizon to above the 1,200-ft. level. The "B" zone, smaller but of better grade, persists from the 1,900 down to the 2,400-ft. level. Dr. D. L. H. Forbes is president and general manager; John C. Perry is mine manager.

★ East Malartic Mines reported the December mill rate at about 850 tons daily, compared with rated capacity of 1,800 tons. The new incline shaft being put down from the 10th level will ultimately open up 16 new levels down to 4,000 ft. The new shaft was raised from the 10th level to surface and four new levels are to be established from 1,750 down to 2,200 ft. Shaft work is scheduled for completion by next July. Andrew J. Davis is president and D. M. MacLean is mine manager.

★ Malartic Gold Fields, Ltd., reports a reduction in mining costs as a result of changing to the new method of incline cut-and-fill stoping. A saving has also been made in dropping ore from the No. 2 shaft down to the 1,200 level for electric haulage to the No. 1 shaft, where it is hoisted to the mill. The previous method was to truck ore on surface between the two shafts. Work is now making good progress in preparation for building the new 1,500-ton mill at the No. 2 shaft. Construction is to be started in the spring. Development has been concentrated on the 600 and 750 levels at the No. 2 shaft. An ore length in excess of 1,000 ft. has been indicated at the 600-ft. horizon. On the bottom or 1,200-ft. level ore lengths of 880 ft. have been indicated by preliminary work. The average grade of $5.77 from the No. 1 shaft compares with an average of $6.68 per ton from the No. 2 shaft. John Metz is general manager.

ONTARIO

★ General D. M. Hogarth, president of Steep Rock Iron Mines, reported 1946 ore shipments amounting to 826,144 tons. Production in 1947 is to be approximately 1,250,000 tons. Steep Rock ores have commanded premium prices. Open-pit mining on the "B" orebody is to be expanded and a second orebody is to be developed to make possible production in excess of 2,000,000 tons a year. Within five years it is planned to double the loading capacity at Port Arthur. For future operations a lifetime average profit of $1.73 per ton has been indicated before interest, taxes, depreciation, and

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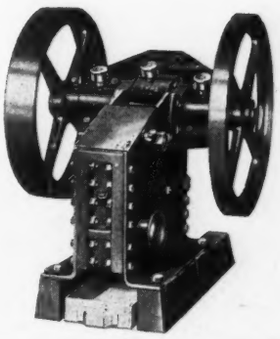

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Canada (*continued*)

pre-production write-offs based on annual output of one million tons. Funded indebtedness of $7,250,000 is expected to be amortized by maturity.

★ Pickle Crow Gold Mines reports mining operations on the upper 750 ft. of the No. 2 vein. Originally developed by an internal shaft from 750 down to 1,225 ft., the new work is made possible by raising to surface as the No. 3 shaft. New levels are also to be developed below 1,225 ft. The No. 1 or Howell vein, 2,000 ft. west of the No. 2 vein, shows decreasing tonnage as well as grade at deeper horizons in the No. 1 shaft, which is to be continued down to open new levels. Promising new ore chances have been indicated by drill holes put down to test the downward extension of the Riopelle vein in an iron formation south of the west end of the Howell vein. Total production at Pickle Crow to June 30, 1946, was valued at $22,844,957. Ore grade in 1945 averaged $21.44 per ton. Alex G. Hattie is mine manager.

★ V. G. McKee, mine manager at Hasaga Gold Mines, operating in Dome Township, Red Lake area, west of the Howey mine, reports that crosscuts on three deep levels are expected to reach the ore before the end of February. The levels are at depths of 1,800, 2,000, and 2,200 ft. At the main operating shaft a 115-ft. steel headframe is being erected. Shaft sinking is advancing from surface to connect at 750 ft. with the winze that reaches a depth of 2,300 ft. Three important new oreshoots below the 1,600 level were indicated a year ago by diamond drill holes, and the 400-ton mill was shut down to permit full attention to the extensive development program. The No. 1 shaft reaches a depth of 1,050 ft. John E. Hammell is president.

★ At Madsen Red Lake Gold Mines the resident manager, E. G. Crayston, reports satisfactory results from depth development on the main ore zone. To a depth of 1,959 ft. the No. 2 shaft gives access to 11 levels, of which the deepest is just entering the ore. From the 7th down to the 10th level ore lengths of better than 500 ft. have been developed. The ore reserve estimate on May 31, 1946, gave 1,041,000 tons. Joseph McDonough is president.

MANITOBA

★ The Saskatchewan government has granted permission to Hudson Bay Mining & Smelting Co., Ltd., to add a 19,000-hp. unit to its power plant at Island Falls, on the Churchill River. The completion of this new unit will make available a total of 109,000 h.p., which, in addition to supplying Hudson Bay's requirements, will be utilized to serve the Sherritt Gordon mine, at Sherridon, as well as the Howe Sound operation at Snow Lake, for which a power line is being built.

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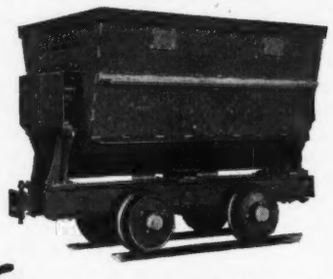

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★ Ogama-Rockland Gold Mines, Ltd., announces that shaft sinking has been completed to a depth of 400 ft. and that lateral work is under way on three levels. The main shear zone was intersected while cutting the station on the second or 240-ft. level, exposing two parallel veins. One assayed $2.80 across 0.9 ft. and the second $136.50 across 1.3 ft.

★ Goldbeam Mines, Ltd., has suspended operations until spring. Approximately a third of the exploratory work planned has been completed. Results obtained to date are reported to be inconclusive. Driving north and south from the shaft on the 150-ft. level yielded some encouraging assays, but no oreshoot was indicated. Additional underground diamond drilling has been recommended prior to the resumption of lateral work.

★ Progress is reported in drifting operations at the Ferro property of Wekusko Consolidated, Ltd., on the east side of Herb Lake. On the 275-ft. level continuous sections from west to east gave average assay values as follows: 0.168 oz. gold across 4.6 ft. for 53 ft.; 0.29 oz. across 4.7 ft. for 20 ft.; 0.25 oz. across 3.3 ft., for 65 feet. A second shoot some 90 ft. farther east has averaged 0.247 oz. for a length of 38 ft. across 3.3 ft. Development on the two deeper levels has not advanced to the same extent. On the 400-ft. level, east of the shaft, the first 33 ft. averaged 0.37 oz. across 1.5 ft., followed by 42 ft. averaging 0.288 oz. across 4.7 ft. Drifts east and west on the bottom 525-ft. level have advanced a total of 21 ft. with face samples averaging 0.119 oz. across 4.1 ft.

★ A company to be known as Jeep Gold Mine, Ltd., has been formed to develop a new gold prospect some nine miles northeast of the San Antonio mine. The capitalization of the company is 3,000,000 shares of no par value, of which San Antonio Gold Mines, Ltd., will acquire a 75% interest for the expenditure of $550,000. The main surface showing is 200 ft. long averaging 2 oz. gold across 12 in. This vein has been intersected by diamond drilling at approximately 200 ft. vertical depth with values comparable to those obtained on the surface. Equipment necessary for underground development will be transported to the property during the winter. Sinking will probably be delayed until spring, due to an inadequate water supply.

BRITISH COLUMBIA

★ Work has been resumed at producing mines following termination of the strike called on July 3 by the International Union of Mine, Mill and Smelter Workers.

★ Surf Inlet Consolidated Gold Mines, Ltd., will discontinue, temporarily at least, further work on the higher levels of the Pugsley mine, on Prin-

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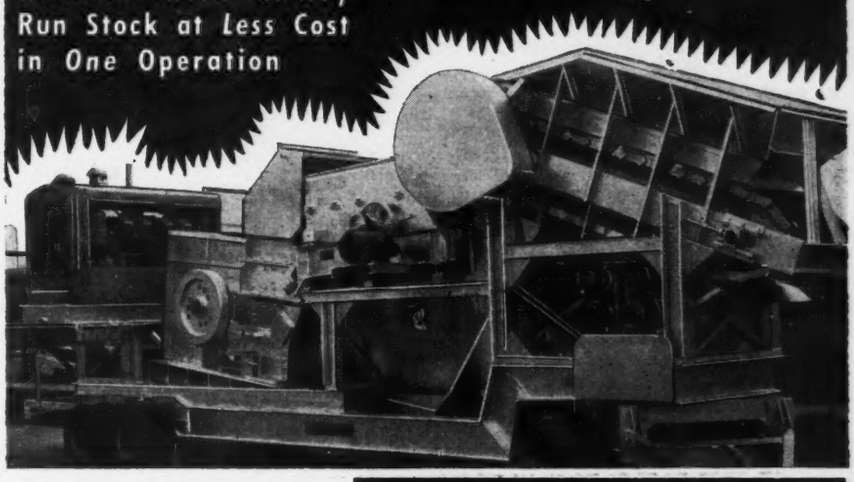

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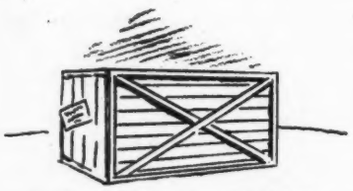

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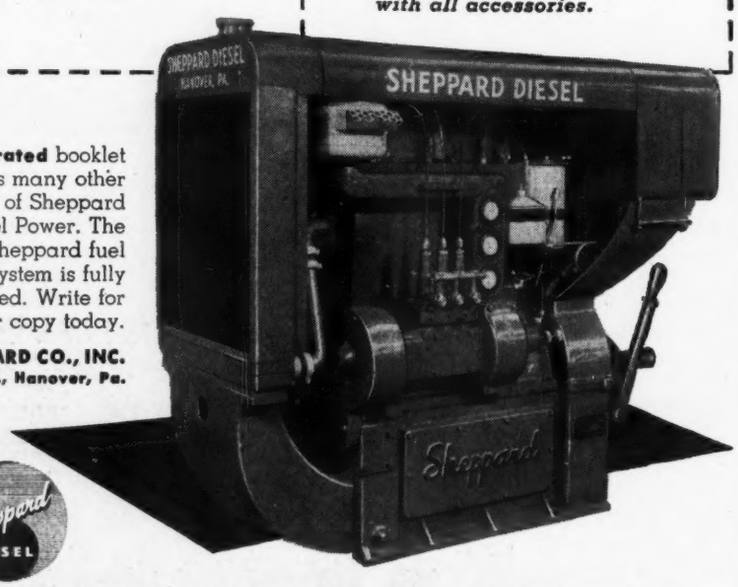

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Canada *(continued)*

cess Royal Island. It is proposed to establish a new and deeper entry further down the slope by driving 1,000 ft. before sinking, to effect connection with the recent discovery of high-grade ore on the Pugsley 13 level, where one oreshoot, 43 ft. long, averaged 0.795 oz. gold per ton over 6.8 ft. Caving of the upper Pugsley levels and the high cost of hoisting ore have been given as reasons for the proposed change. The annual meeting of shareholders on Dec. 18 was informed by W. H. Hax, president and managing director, that intensive prospecting would be initiated in 1947 on the company's McVicar group of base-metal claims, adjoining Britannia at the head of Howe sound.

★During the few November days in which the mill operated, Privateer Mine, Ltd., in the Zeballos district, produced 200 oz. gold. A spectacular discovery of high-grade ore has been made in a raise being driven from the 1,100 to the 1,000 level on the No. 3 vein. The net average assay of three samples taken from the face of each advance was 15.5 oz. gold per ton over a width of 7 in. The value of ore extracted in the first three rounds was estimated at $12,152. Drifting is in progress on the same vein on the 1,200 level and a crosscut will be driven to explore the vein on the 1,300 level. At the company's Tofino property, 108 ft. of drifting has been done since the last report. The 1,700 level was advanced 88 ft. in ore, extending the second shoot to 175 ft. averaging 0.97 oz. gold per ton across 1.6 ft. The 2,100 level was advanced 20 ft. in ore, extending the second shoot on that level to 125 ft. averaging 1.22 oz. across 1.3 ft. It is planned to drive a main haulage level on the vein at the 1,500-ft. horizon. N. E. McConnell, managing director, states that indicated reserves as of Nov. 24, allowing 50 ft. above and below drift ore lengths where not yet correlated with adjacent levels, were 72,300 tons averaging 0.39 oz. gold per ton over a mining width of 5.0 ft.

★Twin "J" Mines, Ltd., in the Victoria Mining Division, has been unable to resume production because of the shortage of developed electric power on Vancouver Island. Delivery of power from the new Campbell River project is expected in February, and, as a result, directors have set March 1 for the reopening of the mill. In the meantime the North and South orebodies in the Tyee and Lenora mines are being readied for stoping and a considerable supply of ore has already been broken. Diamond drilling and drifting will be done to explore the Richard III mine, where the company has high hopes of obtaining a better proportion of precious-metal content. The mill has been equipped with additional jigs and blankets which are expected to increase gold recovery and to retrieve the small lead content pre-

viously lost. The property is equipped with a modern 150-ton selective-flotation mill installed in 1943 by Wartime Metals Corporation in its effort to augment zinc production.

★ Large-scale dredging in the Princeton area is foreshadowed by the incorporation of Atkinson Placers, Ltd., to acquire title to and develop 40 placer leases on the Similkameen and Tulameen rivers and their tributaries. Properties include 700 acres in the Boise Basin of the State of Idaho, and dredging equipment is valued at $100,000. The equipment, now being shipped from Idaho, consists of a standard-type gold-dredging processing plant with rated capacity of 5,000 cu.yd. daily, and is specially equipped with Pan-American jigs to recover platinum and fine gold previously lost by clogging of the riffles. Estimated reserves are extensive and range in value from 41c. to 92c. per cubic yard in gold and platinum. Work will start this spring.

★ Highland-Bell, Ltd., Beaverdell district silver producer, has secured an option to purchase six adjoining claims on a cash royalty basis. J. C. Dumbrille, general manager, explains that underground work on the lower levels has indicated that a segment of the vein crosses the line into one of the optioned claims. A winze is being sunk from the 8th or bottom level of the Highland Lass mine to provide a new low level. At the same time crosscuts are being driven from the 7th and 8th levels to reach an entirely new structure indicated by diamond drilling.

YUKON

★ The City of Dawson, Yukon Territory, hopes to be provided with road connection to the Alaska Highway during 1947. The Alaska Road Commission is constructing an all-weather road from Tok Junction, on the main highway, to Chicken Creek, which is within five miles of Jack Wade, now connected with Dawson by truck road.

The value of such a connection to the rapidly expanding mining industry in the Dawson and Mayo districts is illustrated by Franklin L. C. Price, managing director of Yukon Explorations, Ltd., dredging operator in the Sixtymile area. He estimates freight can be hauled from tidewater over the projected connection and landed in Dawson at a cost of $45 per ton, which is approximately half the cost of transportation at present provided by rail and steamer. During 1946, Price states, Yukon Explorations paid 44.8c. per U. S. gallon for diesel oil landed at Sixtymile. This could be delivered for 22.5c. by road, he estimates, permitting a saving of $22,300 per year to this one operation. Another important reason given for effecting the link is that it would afford a year-round connection, whereas present communication by steamer or airplane is entirely dependent on seasonal changes.

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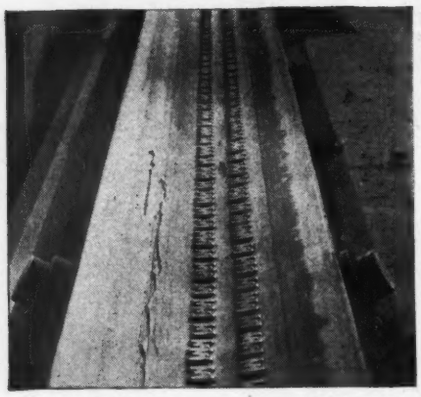

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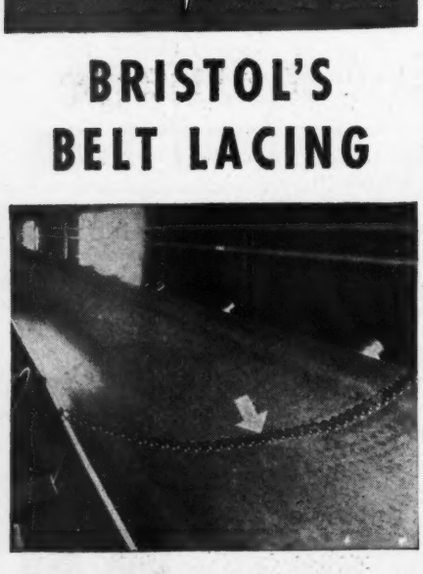

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MEXICO

Labor once more restive—New copper property planned

★ Mexican mining labor, which has been more or less content for some weeks, largely as a result of the recent pay increase granted as its one-third share in the silver price increase, is again becoming assertive. The miners' union, which claims 85,000 members, considers that pay must be still further increased to meet rising living costs. The union is arranging a convention for Mexico City at which contract terms for future negotiation will be discussed. Emphasis will no doubt be on wage increases.

The miners' union has made formal complaint against Cia. Minera Eureka, Concepcion del Oro, Zac., and Cia. Internacional de Fundiciones y Minerales, Guerrero, that they have not allowed their employees the third share in increased revenue from silver that was ordered by President Avila Camacho.

The union also announces its sympathy with the oil workers in their recent dispute with the government oil company, during which President Miguel Aleman called out troops to prevent sabotage and keep plants running. Employers generally seem optimistic about the new Aleman government, but its attitude toward mining has not yet been clarified.

★ Ten silver miners were killed and 15 others were injured when the truck in which they were riding went off a road and crashed into a ravine near Pachuca recently. Pachuca police blamed the acident on the driver.

★ Ernesto Rios, 5 de Mayo, 24, Mexico, D.F., plans to begin operations soon at a copper property near Santa Fe in Pichucalco municipality, Chiapas. A 2,000-ton mill is planned.

CHILE

M'Zaita may reopen its mines and Chagres smelter—Strikes cause great loss to country

★ Cie. Miniere du M'Zaita, whose mines, mills, and smelter have been closed since Metals Reserve Co. contracts were ended a year and a half ago, is rehabilitating ropeways, bins, and machinery of both the Soldado and the Cerrado mills (600 and 120 tons daily respectively). It is believed that the company may resume operations as soon as some points relating to taxation are cleared up with the Government. If the company's Chagres smelter between Santiago and Valparaiso is reopened, it will help central Chile's gold and copper mines considerably toward again making the district productive.

★ Development work at the Buenos Aires lead-zinc mine, in Aysen, in southern Chile, is said to continue satisfactorily, now that melting snow permits access to outcrops.

★ Among resolutions approved at a recent Santiago convention of the Chilean Institute of Mining Engineers were the following: that foreign capital be welcomed to help develop Chile's mineral resources and that it be allowed to take out of the country enough exchange to amortize its investment plus a fair interest; that mineral industry curricula be standardized as among the American countries so that degrees resulting therefrom would permit the holders to practice anywhere in the Americas; that the government spend $17,000,000 in a 10-year mineral exploratory program; that the Government copper smelter planned before the war now be built.

★ Senator Videla Lira, president of the mining society, in a recent speech in the Chilean Senate, pointed out the great harm being done the country by the current wave of strikes. Production of copper has fallen to 320,000 metric tons this year from last year's 450,000 tons as a result of strikes. The Braden strike alone lost about $5,000,000 in foreign exchange in addition to the $2,400,000 in Chilean currency that should have accrued to the Government out of the artificial exchange rate at which the copper companies buy their pesos. Strikes at the nitrate plants and ports have cost another $4,000,000. It is estimated that the deficits for 1946 and 1947 combined will leave the country short about $100,000,000 of the dollar exchange that it really needs.

★ The Chilean Government mission that went to Argentina has announced that part of the loan of 700,000,000 Argentine pesos that will be made to Chile will be spent in building a copper smelter and an electrolytic refinery. The smelter would be located near Copiapo and the refinery at the port of San Antonio, where there will be cheap hydroelectric power from the new Sausal plant near Rancagua, now being built by the Corporacion de Fomento.

AUSTRALIA

Gold strike near Kalgoorlie—Mt. Morgan operates at higher rate—Bauxite ores studied

WESTERN AUSTRALIA

★ It is apparent that Australia is not desirous of allowing the Japanese to return to the sources of minerals that they once worked on or within range of the continent. For example, Australia has re-let the iron ore leases in the Yampi Sound, in Western Aus-

tralia, to the Broken Hill Proprietary Co. Before the war, these properties were leased to a syndicate composed of the Nippon Mining Co. and the Brassert Co., an English mining concern. All the ore was to be shipped to Japan, although very little ever reached the Islands. Australia is also attempting to obtain title to the richest of the bauxite ore reserves on the Malay Peninsula, formerly worked by Japan.

★ Rich gold ore has been reported from the Mountain View Mine, operated by a private syndicate near the northern end of the old Fingall property, Kalgoorlie, Western Australia. It is said to have paid £100,000 from the 2,000 tons of ore. The present strike was made at the 350-ft. level, where one six-ton lot of ore contained 8,000 oz. of gold.

QUEENSLAND

★ Mount Morgan, Ltd., mined a greater tonnage of material in the year ended June 30, 1946, than in the previous year. Total tonnage of ore and overburden mined was 1,772,359 tons, compared with 1,320,310 tons in 1945, and of this total, 646,567 tons was delivered to the sulphide mills and 1,125,792 tons was discarded as waste. The grade of the sulphide ore was 2.5 dwt. gold and 0.56% copper, the grade of ore treated in the previous year being 2.72 dwt. gold and 0.67% copper. Ore mined outside the calculated ore reserves amounted to 63.25% of the mill feed, compared with 46.45% in the previous period. The ore was mined from four benches in the open cut, at 363 ft., 450 ft., 574 ft., and 650 ft. from surface. Comparative assay values of reserve ore and ore outside reserves, treated during the year, were:

	Tons	Au. Dwt.	Cu. %
Reserve ore	175,311	4.65	0.64
Stope fillings	50,317	3.05	0.20
Ore outside reserves	388,352	2.35	0.58

Ore reserves were estimated at:

Sulphide ore, tons	5,542,294
Assay value: gold dwt.	4.23
Copper, %	1.90
Additional indicated material, tons	3,004,252
Assay value: gold, dwt.	1.65
Copper, %	0.43

Skilled labor was scarce, and the shortage retarded development. Two new 2½-cu.yd. electric shovels were put into operation during the year, and have favorably influenced mining costs. Four additional trucks, with 10- to 12-ton payload capacity, have been added to the transport serving the shovels. Churn drills, wagon drills, and jackhammers are used for breaking ore and waste. After long delay, due to wartime controls, the company has been able to obtain bulldozers for cleaning up the benches. Ore mined on the benches is passed to an underground crushing station at the 650-ft.

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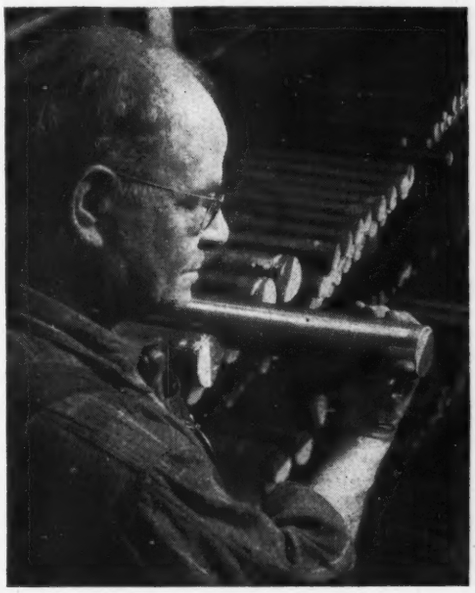

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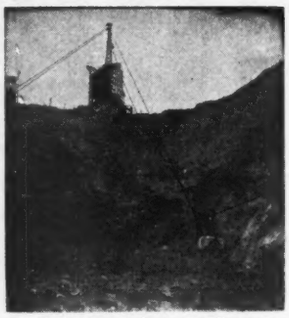

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Australia (*continued*)

level, and is hauled up the main incline shaft to surface. The ratio of overburden removed averaged 1.83 tons to 1 ton of sulphide ore delivered to the mills. Both Nos. 1 and 2 mills were in operation and treated 614,700 tons of sulphide ore assaying 2.5 dwt. gold and 0.56% copper. Tailings assayed 0.97 dwt. gold and 0.091% copper. Concentrates produced totaled 29,733 tons with an assay value of 32.5 dwt. gold and 9.9% copper, the ratio of concentration being 20.7:1. Total gold production was 48,256 oz. and copper production was 2,935 tons. Percentage recoveries were: gold, 62.9; copper, 84.7; the recoveries compare with gold, 58.1%, and copper, 85.6% in the previous year. Lime used in treatment was 31.8 lb. per ton of ore. The smelter produced 3,064 tons of blister copper, estimated to contain 3,029 tons of copper, 51,719 oz. of gold, and 17,912 oz. of silver. No. 2 reverberatory furnace operated 498 days since arch repairs were previously carried out, the life being attributed to the effectiveness of the method of hot patching, for repairs to the arch and side walls, during normal furnace operation. Operating costs were:

		Cost per Ton S.	D.
Sulphide ore:	Mining	11	3.82
	Treatment	6	9.38
		18	1.20
Mining: Total material mined		3	11.93
Smelting: per ton copper		£A30-15-	7
Power: per kw. hr.			0.6097d

Electric power is steam generated, using coal from the company's colleries in the Dawson Valley. Total units amounted to 30,307,010 kw. hr.

NEW SOUTH WALES

★ North Broken Hill, Ltd., at Broken Hill, mined 325,393 tons of ore in 1945, bringing the total ore mined to date to 15,700,000 tons. Ore is mined from two sections the respective values being:

	Lead, %	Silver, Oz.	Zinc, %
North section	15.3	8.3	11.9
British section	12.1	6.1	10.3

Concentrate production during 1945 amounted to lead, 64,242 tons; and zinc, 63,875 tons.

In the southern orebody, the general layout is alternate stope and pillar, with strike lengths of 10 sets and 5 sets respectively; with a 6 ft. 4 in. square set unit, the stope length is 63 ft. 4 in. and the pillar length 31 ft. 8 in., giving a total section length of 95 ft. At the 2,450 ft. level, stopes will be five sets long, with pillars three sets long; one crosscut only, will be required per stope, and the same cross-

cut will be used later for pillar extraction. The crosscuts are driven at 54-ft. centres. On the 2,600 ft. level, stope and pillar dimensions and crosscut spacing will be the same as at the 2,450 ft. level, but no stopes will be formed at the level horizon in the central part of the orebody. Rises for ore chutes and ladderways will be put up through a horizontal bridge of ore and stoping will start at 30 ft. above rail level. Lode pillars are mined by underhand quare-set method, starting from a vertical winze sunk as close as possible to the hanging wall.

The hanging wall section is worked first, retreating to the footwall. Deslimed current mill tailings are used for underground filling, which, on the newer levels, is distributed by belt conveyors from the main sand passes to the lode winzes. When the conveyor gangways ultimately collapse, pneumatic methods are used for distributing and placing the filling. By this method, filling is distributed for distances up to 1,000 ft., the average distance being 300 ft. to 400 ft., and approximately 50 cu.yd. of filling can be placed per shift.

VICTORIA

★ Preliminary work toward the establishment of the aluminum ingot industry in Australia is progressing. The principal work at present is the examination of the higher-grade bauxite deposits which will be mined to supply the treatment plant. This plant is to be erected in Tasmania, where ample hydroelectric power is available. Tasmanian bauxite deposits are rather small and scattered, and the grade does not greatly exceed 40% alumina, though there are deposits of limited extent worth close to 50% alumina. The highest grade ore, so far available, is located within an area of 150 sq. mi. in Gippsland, Victoria. The Commonwealth and the State Department of Mines have carried out extensive surveys, which have resulted in the discovery of 24 deposits, none of which is more than six miles from a railway. Western Australia has been examining country likely to contain occurrence of bauxite, and an area of 500 sq.mi. in the Daring Ranges has been mapped, as containing deposits with an alumina content of 27 to 50%.

PHILLIPINES

Mining in rehabilitation stage for two properties

★ Rehabilitation of Mindanao Mother Lode mine, in Surigao, is progressing rapidly since work began in August 1945. New mill machinery and a new power plant were ordered from the States a year ago, and the equipment is expected to arrive in Manila in January 1947. Two large diesel engines of the company were repaired and are now in operation. The old mill site was cleaned up and the foundation of the new mill is being laid out. Mine repair has begun with the main haulage level, which has been reopened and damage found to be slight. The old shaft is in good condition from the collar to the water level 60 ft. below. Timber above water level is still in good condition. The crosscut to the second shaft has also been cleaned up, but this shaft is badly damaged. The crosscut to the new No. 50 vein is being opened up, but considerable caving has taken place. 300 laborers are now employed with wages from P1.25 to P1.07 a day. This wage scale is about 25% higher than prewar. The company sells food supplies, especially rice, to its men below cost. It is expected that the new mill will be in operation about the middle of 1947. Rehabilitation is in charge of Larry Smith, former mine superintendent of the company. A. N. Crenshaw is now mine superintendent.

★ Surigao Consolidated began milling in August 1946. It is the first mining company to mill after the war. Daily capacity averages 135 tons. Four flotation units are being installed, which will bring mill capacity to 200 tons daily. Oxidized ore from the open pit, after being washed and ground, is sent to Wilfley tables for concentration. A flotation product is also made. Concen-

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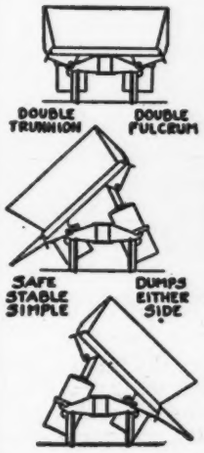

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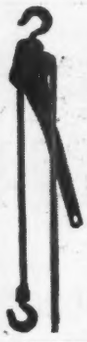

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Philippines (*continued*)

trates consist of free gold, galena, sphalerite, and a little chalcopyrite. In the final flowsheet, it is planned to amalgamate the free gold in the concentrate, and the sulphides will be reground to minus 300 mesh and cyanided. Both oxidized ore and sulphides from underground will be treated. The mill feed at present carries values from 0.15 to 0.20 oz. in gold. Recovery is low, and although the process is still in the experimental stage, values are enough to pay mining and milling operations. In the normal run of the mill, the recovery is expected to be over 90%. The company estimates there are more than a million tons of oxidized ore in the open pit. The present mining cost of the oxidized ore is P1.50 per ton.

Underground workings have not been opened as yet. The main shaft must be retimbered completely. Repairs in the mill are going on satisfactorily and full mill production is expected by March. The machine shop is almost completely rehabilitated, and has been of immense service in repair work. Houses for miners and staff members are being built, and 600 men are employed. A primary grade school has been opened by the company for the camp children. Logs are delivered to the company's saw mill by tractor from the concession about 2 km. away at a cost of 4 centavos per board foot. J. B. Harrison is the general superintendent, assisted by R. W. Gorler, mill superintendent; H. E. Heide, mine superintendent; and S. Sjoberg, master mechanic.

AFRICA

Diamond sales in 1946 set new high level—Rand operator sees State as partner

★ A suggestion that the State should determine in advance what proportion of gold-mining profits it would require as a partner in the enterprise, and that lease formulas should be so devised as to cover the whole of that proportion, was made by the chairman of Anglo-Transvaal Consolidated Investment Co. in his address at the annual meeting. After the proportion had been determined, the profits from gold mining should be free from all other impositions—from State, provincial, or municipal authorities. Recipients of dividends, of course, would still remain liable to the tax levied on companies or private individuals.

★ Points affecting the economic interests of the Union's gold-mining industry were put convincingly by Robert Annan, chairman, at the annual meeting of Consolidated Gold Fields of South Africa. He analyzed factors responsible for rising costs on the Rand and pointed out that there was no simple remedy. The interests most concerned, labor, government, and capital, to name them in the order of their participation, must combine in efforts to check rising costs and improve productivity. Annan showed that in 1932, before the gold price increase, costs took 14 dwt. of each ounce of gold produced. The proportion fell to 11 dwt. when the price rose, but costs then also began to rise and, except for a small reversal in 1939 and 1940, the rise continued until today costs again absorb over 14 dwt. of each ounce.

★ The enthusiasm that greeted the announcement of a strike of 1,085-in. dwts. in Borehole No. 2 on Farm Rietpan 674 of Blinkpoort Syndicate was dampened soon after the news was received when it was realized that the results had already been reported some time before in the company's quarterly report. The later announcement included additional data. No other unusual borehole results have been reported; most assays run in the neighborhood of those previously reported. Borehole No. 2 on Geduld farm 697, situated about 4,000 ft. from the famous Geduld No. 1, has cut two gold-bearing reefs of moderate value, and has gone on to the Basal Reef at 4,865 ft., yielding an assay of 5.64 dwt. over a true width of 47.9 in., equivalent to 270 in. dwt.

★ It was announced recently at a special meeting of DeBeers that diamond sales for 1946 would reach a new record figure of £30,000,000, an increase of £5,500,000 over 1945. Sales of gem stones account for the bulk.

★ Miners at the high-grade Blyvooruitzicht mine went on strike in October for a 9d. per fathom increase in their stoping pay. The 24 stopers took out with them the entire local membership of the Mineworkers Union, 125 men, and the November production of Blyvoor suffered accordingly. The men returned to work after several days, and the demand will be arbitrated.

★ Effect of increase in Rand working costs for the first nine months of 1946 is shown in the following table; relevant figures for Jan.-Sept., 1945, are included:

	1946	1945
Tonnage milled...	42,684,200	44,086,700
Yield, oz.....	8,949,063	9,129,256
Working revenue..	£74,500,586	£76,164,509
Working costs....	£54,528,850	£52,166,240
Working profit...	£19,971,736	£23,998,269
Profit per ton milled	9s 4d	10s 11d
Cost per ton milled	25s 7d	23s 8d
Cost per fine oz...	126s 9d	118s 6d
Yield per ton milled	4.031 dwt.	3.994 dwt.

★ Oscar Weiss, a South African geophysicist, and a survey group are understood to be now at work in the Mpanda mineral area of Tanganyika Territory, where a large lead orebody was reported some time ago by J. de la Vallee Poussin, now managing director of Uruwira Minerals, the exploiting agency. Mr. Weiss is consultant to Union Corporation.

Milling Review

(*Continued from page* 104)

plant and reported by I. M. LeBaron in A.I.M.E. T.P.2079. A fatty acid float recovers the phosphate and some of the silica; then an acid leach kills the fatty acid, and an amine float removes the last of the silica.

Up in Canada, Kerr-Addison now has the equipment to double its capacity to about 4,000 tons daily, which, considering the grade of its ore, should make it second only to Homestake among North America's gold mines.

Roan Antelope's Flowsheet

Down in Africa, Roan Antelope reports that elimination of a second stage of cleaning now leaves the company's flotation process as follows: a scalping float in the grinding circuit, a roughing and scavenging float in mechanical machines, and cleaning of combined rougher and scalper concentrates in air-lift machines. Two-cell 48-in. M S machines are used ahead of the secondary classifiers in the grinding circuit, where they recover some 60 to 70% of the recoverable copper in a 48% concentrate, leaving a feed of 1% copper for the roughers. A 24% concentrate is taken from the first four cells of each of the 30 Agitair 18-cell roughers. A 2.5% concentrate from the remaining 14 scavenger cells goes back to the float feed. The scalper and rougher concentrates are cleaned in two 22-ft. air-lift machines to produce a finished concentrate of 50 to 52% copper and a tailing of 10% copper that is reground and returned to the float feed. The single stage cleaning has cut pumping and air costs and control has been simplified.

Plant tests on reagent control have resulted in lowered reagent consumption and the complete elimination of cresylic acid. The following figures are typical.

	Reagents Used, Lb./Ton Milled	
	Previously	Now
Pine oil	0.087	0.060
Cresylic acid	0.067	None
Potassium ethyl xanthate	0.068	0.034
Sodium sulphide	0.217	0.145

No lime or other conditioning reagents are required to hold the mill pulp to pH 8.1 to 8.3.

A new frother has been tested at Roan Antelope that is an alcohol derivative produced in South Af-

(*Continued on page* 170)

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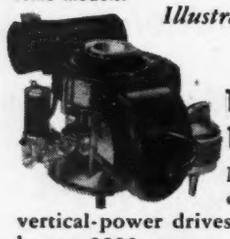

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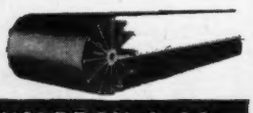

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Milling Review (*continued*)

rica. It gave excellent frothing but worked so rapidly that it can apparently be used only by adding the reagent at several points along the line of 18 cells. Pine oil, however, can be added ahead of the roughers. Because there are 30 banks of 18 rougher cells each, use of the new frother would call for an extremely complicated and elaborate reagent feeding system.

Plant Tests at Mufulira

Over at Mufulira, tests with reagents have also been made, and as a result a coal tar frother from Natal has replaced about half the company's pine oil. Dextrin is used as a depressant, and B-23 worked well as a substitute for pine oil but was ruled out on the price basis. Calgon is used to prevent lime scale. Xanthate consumption is controlled by daily tests using water from the tails on a standard sample of ore, which results in keeping a safe excess of xanthate in the circuit, although consumption varies in a month from say 0.08 to 0.24 lb. per ton of ore.

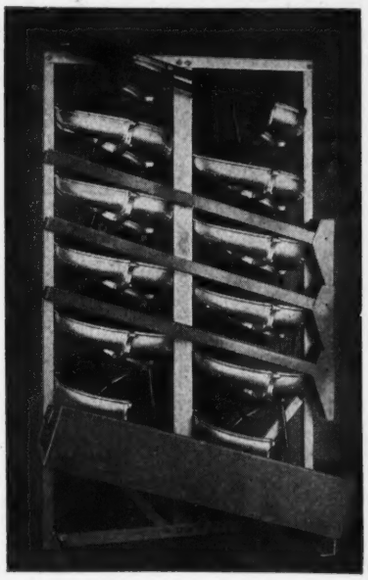
Mufulira has installed mechanical flotation machines to replace airlift cells and is now using turboblowers instead of the positive displacement type. Open-circuit secondary crushing was tried recently and given up because of the trouble then caused by patches of muddy ore. A large circulating load muscles the muddy ore on through without trouble. Single-stage classification has replaced two-stage and gives good results on grinds up to 60% minus-200 mesh.

New Things Coming

In addition to the foregoing, there are other new developments on the fire about which we cannot even hint, and the years ahead look better than ever. New reagents, new equipment, new processes, new ideas—all these things will make life more interesting, if more complex, for mineral dressers. If this discussion proves anything, it is that our horizons are broadening each year and our interests becoming more manifold.

I wish it were possible here to mention individually the many members of the profession who so kindly supplied me with much of the information on which the foregoing is based. Their essential part in preparing this review is most gratefully acknowledged.

HUMPHREYS SPIRAL CONCENTRATOR



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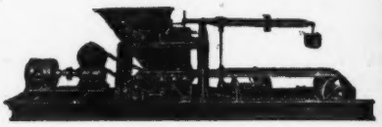

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